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## PHILIPPINE AMPHIBIA

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TEN PLATES AND NINE TEXT FIGURES

### INTRODUCTION

The Philippines are rich in species of Amphibia, no less than sixty-six being treated in this work, which are, probably, not more than three-fourths of the species that exist in the Islands. Borneo has about 80 known species; New Guinea, 70; Sumatra, 42; Java, 47; Japan and Formosa together, about 50.

No extensive collection of Amphibia has been made in the Philippine Islands, and many of the larger islands have not a single record for specimens. Palawan and Mindanao appear to be better known than Luzon or the Visayan or Sulu groups. Very meager collections have been made in Samar, Leyte, and Mindoro, and apparently none have been made in Bohol, Cebu, or Panay.

### LOCAL NAMES

Frogs and toads, with the exception of a rare cæcilian in Palawan, constitute the known Amphibia of the Philippines; they are known in the Islands under the Spanish names *rana* and *sapo*, and in the Philippine dialects, under a wide range of generic names. The best known are *palacá* (Tagalog), *talapang* and *cabacab* (Bicol), *panca* (Negros Visayan), and *baqui* (Leyte Visayan). Very few persons differentiate the various species; thus, in the Tagalog dialect three names are applied to the various species; these are *palacang-saguing* for *Polypedates leucomystax*, *palacang-bato* for *Kaloula picta*, and *palacá* applied

indiscriminately to various other species. The Visayans of Negros recognize only two species; these are *Rana moodiei*, known under the name of *panca bubungan*, and *Rana erythraea*, known as *panca-manwit*. Among the Manobos of eastern Mindanao I found a greater number of specific names than elsewhere, no less than eight being in use. On the other hand, there appears to be no class or generic name for the group. The species designated are:

Species.	Manobo name.
<i>Oxyglossus lævis</i>	<i>Ompo</i> .
<i>Rana leytenensis</i> and <i>Rana magna</i>	<i>Ambac</i> .
<i>Rana grandocula</i>	<i>Côle catóc</i> .
<i>Polypedates leucomystax</i>	<i>Ali cá cá</i> .
<i>Polypedates appendiculatus</i>	<i>Piong</i> .
<i>Cornufer laticeps</i>	<i>Bag-boag</i> .
<i>Staurois natator</i>	<i>Antig</i> .
<i>Kaloula conjuncta</i> and <i>Kalophrynus stellatus</i>	<i>Coquat</i> .

I have made little use of local names in the discussions of species, owing to the fact that these names would be of little or no use in determining the species.

#### ECONOMIC VALUE

The economic value of this group is fairly large. Certain species are sold in the markets of the Islands, and large quantities that are caught and consumed by rural peoples are never taken to market. The catch represents a food value of probably more than half a million pesos annually. It seems highly probable that this sum might easily be doubled if frogs were cultivated for market and their skins utilized for leather. In Japan, France, and the United States quantities of skins of these animals are tanned and made into fine soft leather for use in the arts. It has been reported that:

The skins of frogs and toads are used to a limited extent for leather purposes. Two or three factories in France pay much attention to tanning them, obtaining the raw skins from Northern Africa, Brazil and other tropical regions.

The leather is thin and pliable. It possesses a delicate but not especially attractive grain and is used principally for card cases and other small fancy articles.<sup>1</sup>

In many places in the United States, France, and Japan there are large frog farms where frogs are raised for market. The farms are extremely profitable, the product bringing fancy prices in city markets. Usually only the hind legs are sold, and these

<sup>1</sup> Rep. U. S. Com. Fish and Fisheries (1902) 351.



sometimes sell for as high as 10 pesos<sup>2</sup> per dozen. The species ordinarily cultivated in the United States is the bullfrog *Rana catesbeiana*, which is the largest American species. There are two or three Philippine species which attain large size, one of which, *Rana magna*, approaches the size of the American bullfrog. There is no doubt that they could be cultivated readily in the swamps and marshes of the Philippines, or even in rice paddies, provided their enemies, snakes and large lizards, were partially eliminated.

Many toads of the families Bufonidæ and Engystomidæ have poisonous secretions in the skin, which protect them from being eaten by some animals. Snakes, however, will eat most of the species. Only species of the family Ranidæ should be regarded as of value as food for man.

Frogs and toads, particularly in the tadpole stage, destroy many mosquitoes, especially during the rainy season, which is the breeding season for the group. The adults eat quantities of ants, flies, beetles, and other insects.

#### REPRODUCTION

Frogs, toads, and salamanders reproduce by eggs. The eggs are fertilized extraneously, the male clasping the female and remaining on her back during the process of ovulation. As the eggs are being extruded the seminal fluid of the male, which contains the sperms, escapes and flows over and about the eggs, which are fertilized when the sperms enter them. None of the Amphibia, save the cæcilians, has an intromittent sexual organ.

After a given period the young escapes from the egg and passes through a larval stage. During this stage the animal lives for the most part in the water and appears more like a fish than an amphibian. In the salamanders and cæcilians true external gills are developed. In some rare cases the larval stage continues during the entire life of the animal, and it breeds and reproduces even though it has not developed beyond that stage.

In the genus *Ichthyophis*, a representative of the cæcilians, the females place their eggs in underground holes near water. These eggs are about 6 by 9 millimeters in diameter, being more or less oval in outline. In *I. glutinosus* the female coils about the eggs, evidently for the purpose of protecting them from their enemies. The eggs attain a much larger size before hatching; the mature embryo weighs four times as much as the newly

<sup>2</sup> One peso Philippine currency equals 50 cents United States currency.

laid eggs.<sup>3</sup> When the larvæ are hatched, the gills are lost and the young take to the water; but occasionally they come to the surface to breathe. This species attains almost adult size while still in the larval stage, but apparently it does not breed until the adult form is reached. Finally the gill slit closes and the fin on the tail disappears, the animal becoming a burrowing land creature; it is said to drown very quickly when placed in water.

There is no authentic record of the occurrence in the Philippines of the true salamanders. I obtained eggs attached to rocks in running water in a small stream on Mount Maquiling, Luzon, which had the appearance of salamander eggs; but, having no preserving fluid at hand, I was unable to make the study requisite to determine them before they had disintegrated.

Philippine frogs have various methods of laying their eggs. For the most part the eggs are laid directly in the water. Here the eggs hatch, and the young pass through a larval stage of varying duration, in which stage the large finlike tail develops, but there are no legs. At this time they are known as tadpoles. Later they emerge from the water with four developed legs, a miniature replica of the adult, the tail having disappeared. Certain species, notably *Polypedates leucomystax* (the banana frog, *palacang-saguing*), lay their eggs in a mass of froth or foam deposited along the edges of small pools of water, on reeds or plants growing in the water, or on an overhanging bough of a tree at some distance above water. After about three days the eggs hatch; and the young emerge from the mass, fall into the water, and become free-swimming larvæ. The fully transformed young animal is smaller than the larva, when the latter has attained its greatest size. *Polypedates pardalis* lays its eggs in water collected in holes in trees and very rarely, if ever, descends to the ground. *Polypedates appendiculatus* usually deposits its eggs in water collected in the axils of the leaves of wild abacá or caladium. In this species the larval stage is very probably of shorter duration.

On the small island of Little Govenen, near Basilan, I observed a species of *Cornufer*. This island, which contains only a few hundred square meters of land, has neither standing nor running water, even after a heavy rain; yet this species appears to be able to maintain itself. It is not improbable that the young emerge from the eggs fully transformed, as is known to occur in certain extra-Philippine species.

<sup>3</sup> Sarasin, P. and F., Zur Entwicklungsgeschichte der ceylonischen Blindwühle *Ichthyophis glutinosa*, Erg. Nat. Forsch. auf Ceylon (1887-1890).



## FOOD

Frogs and toads are carnivorous, and their food for the most part consists of small insects. However, many species do not depend much on insects. I have examined the stomach contents of numerous species and have found the following: A large specimen of *Rana vittigera* that had just swallowed a full-grown *Kaloula picta*; the stomachs of other species contained tadpoles, earthworms, small pebbles, caterpillars, etc. In the Santo Tomás Museum, Manila, a large specimen of *Rana vittigera* is preserved which had swallowed a 6-centimeter fresh-water gastropod, the sharp apex of which pierced the stomach and body wall and now extends about 2.5 centimeters beyond the body wall in the region of the shoulder. Certain of the Engystomidæ feed almost wholly on ants of various species.

## GEOGRAPHIC DISTRIBUTION

While our knowledge of the distribution of species is far from complete, it may be well to review the known distribution of the families, genera, and species of the Philippine Archipelago, with a view to determining the derivation of the faunas, their relationships, and what light they may throw on the geographic inter-relationships of the various islands within the Archipelago and on the relation of the Philippine group to other island groups in the East Indies and about Australia. Table 1 shows the distribution of the orders of Amphibia in the Orient.

TABLE 1.—Distribution of the orders of Amphibia in the Orient.

Order.	Australia.	New Guinea.	Celebes.	Mindanao.	Luzon.	Palawan.	Borneo.	Java.	Sumatra.	Malay Peninsula.	Asia.	Japan.
Apoda.....						×	×	×	×	×	×	
Caudata.....					(?)						×	×
Salientia.....	×	×	×	×	×	×	×	×	×	×	×	×

The order Apoda is composed of a single family, the Cæciliidæ, represented in the East Indian region by two genera, numbering four or five species. Of the eleven genera of this family recorded in Boulenger's Catalogue,<sup>4</sup> the distribution is as follows:

<sup>4</sup> Boulenger, Cat. Batr. Grad. s. Caud. Batr. Apod. Brit. Mus. ed 2 (1882).

Two genera are Malayan, one of which occurs in India and Ceylon, and the other in southern Asia and Africa; five genera are American; two are African; one is American and African; and one is confined to southern Asia.

There is no authentic record of the occurrence of a species of the order Caudata in the Philippine Islands or in the East Indian and Australian Archipelagoes. It is highly probable that a species may be discovered in Luzon.

The order Salientia is well represented in the Malay and East Indian regions, and among its families and genera we may expect to find evidences of faunal relationships and derivations.

From Table 2 it will be observed that, of the seven families represented in the Oriental Region, only four are Philippine; two of these may be wanting in Luzon, since there is no authentic record of any member of either the Bufonidæ or the Pelobatidæ having been found there. Borneo on the one side, and Celebes on the other, each has representatives of the same four families but of no others.

TABLE 2.—Distribution of the families of Amphibia that occur in the Orient.

Family.	Oceania.	New Zealand.	Australia.	New Guinea.	Celebes.	Mindanao.	Luzon.	Palawan.	Borneo.	Java.	Sumatra.	Malay Peninsula.	Southern Asia.	Central Asia.	Japan.	Europe.	Madagascar.	Southern Africa.	Northern Africa.	North America.	South America.
Ranidæ .....	×	—	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Engystomidæ .....	—	—	—	×	×	×	×	×	×	×	×	×	×	×	×	—	×	×	×	×	×
Cystignathidæ .....	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<sup>b</sup> ×	×
Bufonidæ .....	—	—	×	—	×	×	—	×	×	×	×	×	×	×	×	×	—	×	×	×	×
Hylidæ .....	—	—	×	×	—	—	—	—	×	×	×	×	×	×	×	×	—	—	×	×	×
Pelobatidæ .....	—	—	—	×	×	×	—	×	×	×	×	×	×	×	×	×	—	—	—	×	×
Discoglossidæ .....	—	×	—	—	—	—	—	—	—	—	—	—	—	×	×	×	—	—	×	×	×

<sup>a</sup> In only the extreme northern part.

<sup>b</sup> In Mexico and Florida.

New Guinea, on the other hand, has no known representative of the Bufonidæ, but has representatives of the Hylidæ,<sup>5</sup> and very probably also of the Cystignathidæ, which occurs in northern Australia.

Japan and Formosa have representatives of four families, but the Hylidæ, not the Pelobatidæ, forms the fourth.

Table 3 shows how poorly frogs and toads are represented

<sup>5</sup> Casto de Elera lists *Hyla chinensis* Günther from Luzon and Basilan. This is probably incorrect.



in the Philippine Islands by endemic genera. Only a single, recently described genus, *Hazelia*, appears to be confined to the Archipelago. Fifteen genera, all that are known from the Islands, are found in Mindanao; five of these have been discovered also in Luzon, and ten in Palawan. The five genera known from Luzon also occur in Celebes and Borneo, and two of them occur in Japan; the latter, however, are the widely spread genera *Rana* and *Polypedates*.

TABLE 3.—Distribution of the genera of Amphibia that occur in the Philippine Islands.

Genus.	Oceania.	New Zealand.	Australia.	New Guinea.	Celebes.	Mindanao and Sulu.	Luzon.	Palawan.	Borneo.	Java.	Sumatra.	Malay Peninsula.	Southern Asia.	Central Asia.	Japan.	Europe.	North Africa.	South Africa.	Madagascar.	North America.	South America.
<i>Oxyglossus</i> .....					x	x	x	x	x	x	x	x	x	x							
<i>Rana</i> .....	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<i>Staurois</i> .....						x		x	x			x									
<i>Polypedates</i> .....					x	x	x	x	x	x	x	x	x	x							
<i>Hazelia</i> .....						x															
<i>Philautus</i> .....						x		x	x	x		x									
<i>Cornufer</i> .....	x		x	x	x	x							x								
<i>Microhyla</i> <sup>a</sup> .....						x		x	x	x	x	x	x		x						
<i>Kaloula</i> .....					x	x	x	x	x	x	x	x	x								
<i>Kalophrynus</i> .....						x		x	x		x	x	x								
<i>Chaperina</i> .....				x		x		x	x												
<i>Phrynixalus</i> .....				x		x		x													
<i>Nectophryne</i> .....						x		x			x	x					x	x			
<i>Bufo</i> .....					x	x		x	x	x	x	x	x	x	x	x	x	x		x	x
<i>Megalophrys</i> .....						x		x	x	x	x	x									

<sup>a</sup> Very doubtful in the Philippine Islands.

New Guinea has four genera in common with Mindanao, three of which are also common to Borneo. Celebes has six genera in common with Mindanao, of which only two are found in New Guinea, while all of them are found in Borneo.

Thus, of the fifteen genera, only three might be regarded as having been derived from New Guinea; these are *Phrynixalus*, *Chaperina*, and *Cornufer*. It is significant, however, that single representatives of the two genera last mentioned are known in Borneo. Eleven of the genera, which are for the most part southern Asiatic or Malayan in distribution, have undoubtedly entered our territory from Borneo through the Sulu and Palawan groups.

DOUBTFUL SPECIES AND SPECIES ERRONEOUSLY CREDITED  
TO THE PHILIPPINE ISLANDS

Due to incorrect labeling and incorrect identification some species have been erroneously credited to the Philippine Islands. The following records are open to question:

*Oxyglossus lima* Tschudi.

Reported by Casto de Elera, Cat. Fauna Filipinas 1 (1895) 445, from "Luzon, Abra, Cagayan," with specimen in Santo Tomás University collection. No specimen exists in that museum at the present time.

*Rana chalconota* Schlegel.

Reported by Casto de Elera (op. cit.) as *R. chalconata* Gthr. from "Paragua, Inagaun, Bulacan," with specimens in Santo Tomás Museum. No specimen exists in the museum at the present time. Barbour, Mem. Mus. Comp. Zool. Harvard Coll. 44 (1912) 67, also mentions this species as occurring in the Philippines. He does not state his authority, and I have overlooked the original reference.

*Rana signata* Günther.

Boulenger is of the opinion that *Rana similis* Günther is a synonym of this species. I have not followed him in this conclusion.

*Rana corrugata* Peters.

Reported by Casto de Elera (op. cit.) from "Mindoro, Naujan, Ilocos," with specimens in Santo Tomás Museum. No specimen exists in that collection to-day.

*Rana kuhli* Duméril and Bibron.

Reported by Casto de Elera from Paragua, Samar, and Borongan, with specimens in Santo Tomás Museum. No specimen of this species exists in that collection to-day.

*Rana varians* Boulenger.

This species is very probably a synonym of *R. sanguinea* Boettger.

*Rana macrodon* Tschudi.

This species has long been confused in the Philippine Islands with *R. magna* Stejneger. The presence of vocal sacs in the latter species clearly differentiates it from *R. macrodon*.

*Rana gracilis* Wiegmann.

This species is reported by Casto de Elera (op. cit.) from "Samar, Villa-real," with specimens in Santo Tomás Museum. No specimen exists in that collection at the present time.

*Rana guentheri* Boulenger.

Reported by Casto de Elera (op. cit.) from "Paragua, P. Princesa, Mindoro, Naujan," with specimens in Santo Tomás Museum. No specimen of this species is there at present.

*Rana macrodactyla* Günther.

Reported by Casto de Elera (op. cit.) from Luzon, Laguna, Cagayan, Dinagat, Negros, Zamboanga, and Mindanao, with specimens in Santo Tomás Museum. No specimen of this species is in the museum at present.



**Rana jerboa** Günther.

Reported by Casto de Elera (op. cit.) from "Samar, Loquilocum," with specimens in Santo Tomás Museum. No specimen is there at present.

**Rana luctuosa** Peters.

Reported by Casto de Elera (op. cit.) from "Mindanao, Butuan," with specimens in the Santo Tomás Museum. No specimen of this species is there at the present time.

**Rhacophorus rizali** Boettger.

According to Boulenger, this species is synonymous with *Polypedates pardalis* Günther, an opinion in which I concur.

**Ixalus pictus** Peters.

Reported by Casto de Elera (op. cit.) from Paragua.

**Nectophryne sundana** Peters.

This problematic species of Peters has been included in the Fauna by Müller, III Nachtr. Cat. Herp. Samml. Basel. Mus. (1883) 7. The locality given is Mindanao. On the statement of Jean Roux, Proc. Zool. Soc. London 1 (1906) 64, the type is the only specimen extant. Evidently Müller's specimen has received another designation. The type of this species, as well as the specimen studied by Müller, should be reexamined and the status of the name permanently fixed.

**Nectophryne guentheri** Boulenger.

Listed from Mindanao by Casto de Elera; no specimen is now in Santo Tomás Museum.

**Bufo divergens** Peters.

The species reported from Palawan under this name by Mocquard, Nouv. Arch. Mus. 2 (1890) 153, is regarded by Boulenger, Ann. & Mag. Nat. Hist. VI 14 (1894) 88, as synonymous with *Bufo philippinicus* Boulenger, an opinion in which I concur.

**Bufo biporcatus** Günther.

Reported by Casto de Elera from Luzon, Manila, Batangas, and San Pablo, with specimens in the Santo Tomás Museum.

**Bufo panayensis** Seane.

This species and a snake, *Piesigaster boettgeri* Seane, were reported as originating in Panay. As a matter of fact, they are both West Indian species; the toad is *Bufo lemur*, and the snake is *Epicrates inornatus* Reinhardt.

**Hyla chinensis** Günther.

This species is reported by Casto de Elera from Luzon and Basilan, with specimens in Santo Tomás Museum.

**Hyledactylus pictus** Bibron.

Reported by Casto de Elera from "Luzon, Bulacan." A synonym of *Kaloula picta*?

**Molge sinensis** Boulenger.

Reported by Casto de Elera from "Luzon, Cagayan, Pamplona."

## BIBLIOGRAPHY

- BARBOUR, THOMAS. A contribution to the zoögeography of the East Indian Islands. Mem. Mus. Comp. Zool. Harvard Coll. 44 (1912) 1-203; 8 plates.

In the distributive tables twenty-one frogs are attributed to the Philippines. *Rana signata* and *R. chalconota* are included in the list.

- BOETTGER, OSKAR. Aufzählung der von den Philippinen bekannten Reptilien und Batrachier. Ber. Senck. Nat. Ges. (1886) 91-134.

A check list of crocodiles, turtles, lizards, snakes, and frogs. The list contains the names of twenty-seven frogs, based on records of other authors.

- BOETTGER, OSKAR. Drei neue Wasserfrösche (*Rana*) von den Philippinen. Zool. Anz. 16 (1893) 363-367.

*Rana moellendorffi*, from Culion; *R. sanguinea*, from Culion; and *R. leytenensis*, from Leyte, are described as new. The first two appear to have been collected by Moellendorff, the last by José Quadras.

- BOETTGER, OSKAR. Neue Reptilien und Batrachier von den Philippinen. Zool. Anz. 20 (1897) 161-166.

*Calophrynus acutirostris* (= *Kalophrynus acutirostris*) is the new batrachian described. The type locality is "Culion oder Samar;" collected by Moellendorff.

- BOULENGER, G. A. Catalogue of the Batrachia Gradientia Salientia and S. E. Caudata in the Collection of the British Museum, ed. 2 London (1882) i-xvi + 1-503; 30 plates and numerous text figures.

This splendid work has stood as a basis for much of the recent work on the Amphibia. Two new species are described from the Philippines; namely, *Rana everetti*, from Zamboanga, and *Cornufer guentheri*, from Dinagat. The types were collected by A. Everett. Drawings are given of these two species, as well as of *Cornufer meyeri*, *Rana glandulosa*, and *Polypedates appendiculatus*, which are also found in the Philippines. *Rana mindanensis* is regarded as an uncertain species. The following species are listed from the Philippines:

*Oxyglossus laevis* Günther.

*Rana erythraea* Schlegel.

*Rana macrodon* Tschudi (= probably *Rana vittigera* Wiegmann).

*Rana natatrix* Günther (= *Staurois natator* Günther).

*Rana similis* Günther.

*Rhacophorus hecticus* Peters (= *Polypedates hecticus* Peters).

*Rhacophorus surdus* Peters (= *Polypedates surdus* Peters).

*Rhacophorus pardalis* Günther (= *Polypedates pardalis* Günther).

*Rhacophorus appendiculatus* Günther (= *Polypedates appendiculatus* Günther).

*Rhacophorus maculatus* Gray and var. *quadrilineata* Wiegmann (= *Polypedates leucomystax* Gravenhorst).

*Ixalus acutirostris* Peters (= *Philautus acutirostris* Peters).

*Cornufer corrugatus* A. Duméril.

*Cornufer jagori* Peters.

*Cornufer meyeri* Günther.

*Callula picta* Bibron (= *Kaloula picta* Bibron).

*Callula conjuncta* Peters (= *Kaloula conjuncta* Peters).

*Callula baleata* Müller (= *Kaloula baleata* Müller).



*Bufo brevipes* Peters.

*Bufo melanostictus*.

*Megalophrys montana* Kuhl (= *Megalophrys* species?).

BOULENGER, G. A. On new batrachians from Malacca. *Ann. & Mag. Nat. Hist.* V 19 (1887) 345-348, pl. 10.

Describes *Bufo philippinicus* as new, from Puerto Princesa, Palawan; the type was collected by Everett.

BOULENGER, G. A. Descriptions of new reptiles and batrachians in the British Museum (Natural History)—Part III. *Ann. & Mag. Nat. Hist.* V 20 (1887) 50-53.

*Bufo muelleri* is described as new from Mindanao, P. I. The type specimen was sent to Boulenger by F. Müller, of the Basel Museum.

BOULENGER, G. A. On the herpetological fauna of Palawan and Balabac. *Ann. & Mag. Nat. Hist.* VI 14 (1894) 18-90.

This important contribution lists one turtle, seven lizards, sixteen snakes, and thirteen batrachians. *Rana palawanensis*, *Rana varians* (= *Rana sanguinea* Boettger), *Rhacophorus everetti* (= *Polypedates everetti*), and *Ixalus longicrus* (= *Philautus longicrus*) are described as new. *Rana glandulosa* Boulenger, *Rhacophorus macrotis* Boulenger (= *Polypedates macrotis* Boulenger), and *Leptobrachium hasselti* Tschudi (= *Megalophrys hasselti* Tschudi) are reported from the Philippines for the first time. Specimens and types were collected by Everett. *Rana macrodon* is included, but the species so identified by him was probably *Rana magna* Stejneger, with vocal sacs.

BOULENGER, G. A. Descriptions of new batrachians in the British Museum. *Ann. & Mag. Nat. Hist.* VI 17 (1896) 401-406, pl. 17.

*Rana luzonensis* is described as new from Lepanto, northern Luzon, P. I. The type was collected by John Whitehead.

BOULENGER, G. A. A catalogue of the reptiles and batrachians of Celebes, with special reference to the collections made by Drs. P. and F. Sarasin in 1893-1896. *Proc. Zool. Soc. London* (1897) 193-237, pls. 7-11.

Discusses several species found in the Philippines and treats of faunal relations.

CASTO DE ELERA. Catalogo sistemático de toda la fauna de Filipinas conocida hasta el presente, y á la vez el de la colección zoológica del museo de PP. Dominicos del Colegio-Universidad de Sto. Tomás de Manila, escrito con motivo de la exposición regional filipina. Manila, Imprenta del Colegio de Santo Tomás (1895-1896) 3 vols.

Volume 1 treats of vertebrates; amphibians, pages 445 to 454. The following species listed are regarded as doubtful or incorrect:

<i>Oxyglossus lima</i> Günther.	<i>Rana</i> sp.
<i>Rana corrugata</i> Peters.	<i>Ixalus pictus</i> Peters.
<i>Rana kuklii</i> Günther.	<i>Nectophryne guentheri</i> (Boulenger).
<i>Rana macrodon</i> Günther.	<i>Nectophryne</i> ? = <i>sundana</i> Peters.
<i>Rana tigrina</i> Günther.	<i>Bufo biporcatus</i> Günther.
<i>Rana gracilis</i> Wiegmann.	<i>Bufo panayensis</i> Seane.
<i>Rana guentheri</i> Boulenger.	<i>Hyla chinensis</i> Günther.
<i>Rana macrodactyla</i> Günther.	<i>Hyledactylus pictus</i> Bibron.
<i>Rana chalconata</i> Günther.	<i>Molge sinensis</i> Boulenger.
<i>Rana jerboa</i> Günther.	<i>Ichthyophis monochrous</i> Peters.
<i>Rana luctuosa</i> (Peters).	

FISCHER, J. G. A list of reptiles and batrachians of Mindanao. *Jahrb. Wiss. Anst. Hamburg* 2 (1885) 80 and 81.

Lists *Hylorana erythraea* Schlegel (= *Rana erythraea* Schlegel), *Rana everetti* Boulenger, *Megalophrys montana* Kuhl, and *Microhyla achatina* Boie. The last two records may be considered doubtful.

GIRARD, CHARLES. United States Exploring Expedition during the Years 1838, 1839, 1840, 1841, 1842, under the Command of Charles Wilkes, U. S. N. *Herpetology* 20 (1858) i-xvii + 1-496, with folio atlas of plates.

Two Philippine frogs are listed. *Hylorana mindanensis* (= *Rana mindanensis*) is described on page 52 as new, from Caldera, Zamboanga, Mindanao.

GÜNTHER, ALBERT. Catalogue of the Batrachia Salientia in the Collection of the British Museum. London (1858) i-xvi + 1-160, pls. 1-13.

In this early catalogue the following new species are described from the Philippines: *Oxyglossus lævis*, from "Philippine Islands;" *Ixalus natator* (= *Staurois natator*), from the "Philippines," *Rhacophorus pardalis* (= *Polypedates pardalis*), from "Philippines" and Borneo, and *Polypedates appendiculatus*. *Platymantis plicifera* is also described as new from the Philippines, but this species is the same as *Cornufer corrugata* A. Duméril. Excellent drawings of all these species, except *P. appendiculatus*, are given. The types were collected (very probably) by Hugh Cuming.

GÜNTHER, ALBERT. Notes on some reptiles and batrachians obtained by Dr. Adolph Bernhard Meyer in Celebes and the Philippine Islands. *Proc. Zool. Soc. London* (1873) 165-172, pls. 17 and 18.

Several snakes and lizards are described. Two frogs, *Polypedates similis* (= *Rana similis*) and *Platymantis meyeri* (= *Cornufer meyeri*), are described as new from "Laguna de Bay."

GÜNTHER, ALBERT. List of the mammals, reptiles, and batrachians sent by Mr. Everett from the Philippine Islands. *Proc. Zool. Soc. London* (1879) 74-79.

Seven species are listed from Dinagat or Surigao.

MÜLLER, F. III. Nachtrag Katalog der herpetologischen Sammlung des Basler Museums (1883).

A few Philippine species are mentioned, among which are *Nectophryne sundana* Peters and *Megalophrys montana* Kuhl. These are very probably incorrectly identified.

MOCQUARD, M. F. Recherches sur la faune herpétologique des îles de Bornéo et de Palawan. *Nouv. Arch. du Mus. d'hist. Nat.* 2 (1890) 115-165.

Four frogs are listed, and *Ixalus nubilus* is described as new. This is now regarded as identical with *Staurois natator* Günther. *Bufo divergens* Peters and *Megalophrys montana* Kuhl are listed, but these are probably identical with *B. philippinicus* Boulenger and *M. ligayæ* Taylor.



PETERS, W. Mittheilungen über neue Batrachier. Monatsb. Ak. Wiss. Berlin (1863) 445-470.

Among other batrachians from the Philippines the following frogs are described as new, three belonging to the Ranidæ and one to the Engystomidæ: *Hylædactylus* (*Holonectes*) *conjunctus* (= *Kaloula conjuncta*), from Luzon; *Halophila jagorii* (= *Cornufer jagori*), from Samar; *Polypedates hecticus*, from Loquilocum, Samar; and *Polypedates surdus*, from Luzon. The types of these species were collected by F. Jagor.

PETERS, W. Herpetologische Notizen. Monatsb. Ak. Wiss. Berlin (1867) 13-37.

Describes, among others, specimens from the collections made by Carl Semper in the Philippines. Nine lizards and two snakes are recorded or described as new from the Philippines. The following frogs are described as new: *Ixalus acutirostris* (= *Philautus acutirostris*), from eastern Mindanao; *Leptomantis bimaculata* (= *P. bimaculatus*), from upper Agusan Valley, Mindanao; and *Hylaplesia brevipes* (= *Bufo brevipes*), from Zamboanga, Mindanao. The new genus described, *Leptomantis*, the type of which is *Leptomantis bimaculata*, is no longer recognized as distinct from *Philautus*.

STEJNEGER, LEONHARD. Two new species of toads from the Philippines. Proc. U. S. Nat. Mus. 33 (1903) 573-576.

*Phrynixalus annulatus*, from Davao, Mindanao, and *Kalophrynus stellatus*, from Basilan, are described as new. The types were collected by E. A. Mearns.

STEJNEGER, LEONHARD. Three new frogs and one new gecko from the Philippine Islands. Proc. U. S. Nat. Mus. 28 (1905) 343-348.

The following species are described as new: *Rana mearnsi*, from east Mindanao; *Cornufer worcesteri* and *Philautus woodi*, from Mount Apo, Mindanao. The gecko described is *Lepidodactylus planicaudus*. The types were collected by E. A. Mearns.

#### CLASSIFICATION

### Class AMPHIBIA Linnæus

Stejneger <sup>6</sup> has shown that the long-accepted name Batrachia, as usually applied to this class, is merely a synonym of the much older name Amphibia. 'It consists of three recognized orders as follows:

1. No legs; tail rudimentary; males with intromittent copulatory organ. Apoda.
2. Two or four legs; tail present; no intromittent organ..... Caudata.
3. Four legs; no tail; no intromittent organ..... Salientia.

<sup>6</sup> Bull. U. S. Nat. Mus. 58 (1907) 2.

Representatives of two of these orders, the Apoda and the Salientia, occur in the Philippines, while the Caudata are of very doubtful occurrence. Only a single species of the first order is known from the Philippines. It is a small wormlike animal and has been found only in Palawan. A species of the second order has been reported by Casto de Elera,<sup>7</sup> but I regard this as somewhat doubtful.

On two occasions I was told of the occurrence of a salamander-like amphibian in Cagayan Valley, and I obtained what appeared to be salamander eggs in a small stream on Mount Maquiling, Laguna Province, Luzon. The eggs were surrounded by a thick gelatinous mass. Because of lack of preservative the material deteriorated before study was possible.

It is significant that the Philippine locality given for Casto de Elera's specimen is "Luzon, Cagayan, (Pamplona)." There is no specimen in Santo Tomás Museum at present. If Casto de Elera had a Philippine specimen of a salamander, I doubt greatly that it was *Molge sinensis*. It is quite probable that a new species awaits discovery.

The third group, Salientia, includes all the frogs and toads. It is a large group, represented in the Philippines by four families; namely, Ranidæ, Engystomidæ, Bufonidæ, and Pelobatidæ, each with several representatives, although the first is by far the largest family.

### Order APODA

"No limbs. Tail rudimentary or absent. Frontal bones distinct from parietals; palatines fused with maxillaries. Males with an intromittent copulatory organ." (*Boulenger.*)

This order consists of a single family.

### CÆCILIIDÆ

The characters of the family are the same as those of the order. Many genera are known, but only *Ichthyophis* has been found in Philippine territory. These small batrachians were formerly regarded as snakes. They are small, legless, snake-like, burrowing creatures.

<sup>7</sup> Cat. Fauna Filipinas 1 (1895) 453. *Molge sinensis* Boulenger.



## Genus ICHTHYOPHIS Fitzinger

*Ichthyophis* FITZINGER, Neue Class. Rept. (1826) 36; GRAY, Cat. Spec. Amph. Brit. Mus. II (1850) 60; PETERS, Mon. Berl. Ak. (1879) 931; BOULENGER, Cat. Batr. Grad. Brit. Mus. ed. 2 (1882) 89; Fauna Brit. India, Rept. (1890) 515.

*Epicrum* WAGLER, Isis (1828) 743; Nat. Syst. Amph. (1840) 198; TSCHUDI, Class. Batr. (1838) 90; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 285 and 288.

*Rhinatrema* DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 288.

Squamosal bones in contact with parietals; two series of teeth in upper jaw; usually two series of teeth in lower jaw; tentacle cultriform, exsertile, between eye and nostril; cycloid scales embedded in skin.

Three species are known, only one of which is Philippine.

*Ichthyophis weberi* sp. nov.

*Type*.—No. B1, Bureau of Science collection; collected at Matatgan River, Palawan, P. I., January 28, 1909, by C. M. Weber.

*Description of type*.—Two rows of teeth in upper jaw, the series forming oval arches, parallel to each other, the inner row extending much farther back than the outer but not widening; lower jaw with a single row of teeth, with no evidence of a second row; head oval, eyes distinct, the distance between them very slightly less than width of head between eyes; distance between eyes a little greater than length of snout; tentacle withdrawn, the groove rather moon-shaped, situated anterior to eye near the edge of upper jaw; body surrounded by three hundred twenty-four circular folds meeting on belly in an angle, except those on posterior part of body, which run straight across without an angle; the first three or four folds on anterior part of body fail to meet; a more or less distinct groove from tip of lower jaw to some distance in front of anus along the median ventral line of body.

*Color in alcohol*.—Above yellowish brown, somewhat darker on median part of body; below lighter yellowish brown. Under a microscope the color appears as minute, rounded yellowish dots surrounded by a network of brown. A white spot on tip of lower jaw.

Measurements of *Ichthyophis weberi* sp. nov.

	mm.
Total length	25
Tail	2.5
Width of head at eyes	7.5
Length of snout	5
Eye to nostril	3.5
Eye to tentacle	1.5

*Remarks.*—This species differs from the two other known species in the absence of the secondary row of teeth in the lower jaw. I do not think that this fact warrants the making of a new genus, since we find that the second series of teeth appears to be degenerating, even in *Ichthyophis monochrous*. A single specimen was collected in Palawan by C. M. Weber. I take pleasure in naming this species for Mr. Weber, whose untiring efforts have greatly enriched the natural-history collections of the Bureau of Science.

## RANIDÆ

Upper jaw toothed; diapophyses of sacral vertebræ not or but slightly dilated; sternal structure variable; precoracoids always present; vertebræ procœlian; coccyx attached to two condyles; no ribs; terminal phalanges assume a variety of shapes.

This family is represented in the Philippines by six long-recognized genera; namely, *Oxyglossus*, *Rana*, *Staurois*, *Polypedates*, *Philautus*, and *Cornufer*. A seventh generic name, *Hazelia*, is proposed in this paper for a species recently discovered in Mindanao and Basilan, characterized by a spiny skin, the skin on the head partially involved in the cranial ossification, and bony ridges in the interparietal region.

The largest genus is *Rana*, which includes twenty-three species, or about four-ninths of the Philippine Ranidæ. This colossal cosmopolitan genus will undoubtedly have to be divided into two or more genera. Boulenger<sup>\*</sup> proposes to divide the group occurring in Papua and Melanesia into three subgeneric groups; namely, *Rana* s. str., *Discodeles* n. n., and *Hylorana* Tschudi, using the toe disks and the arrangement of the metatarsals as the basis for this division. Among the Philippine species there appear to be three natural divisions, characterized as follows:

1. Tips of toes not or but slightly dilated; no enlarged disks; no bony "teeth" in lower jaw. *Rana vittigera*, *R. moodiei*, and possibly, *R. parva*, belong to this group.
2. Tips of toes more or less dilated into pads; enlarged "teeth" in lower jaw. *Rana magna* and *R. leytenensis* belong to this group.

<sup>\*</sup> Ann. & Mag. Nat. Hist. IX 1 (1918) 236-242.



3. Tips of toes dilated into regular disks, with a distinct groove around edge of each disk. To this group would be assigned most of the other known Philippine species of *Rana*.

The external distinctions between *Staurois* and *Rana* or between *Polypedates* and *Philautus* are scarcely more "generic" in nature than the obvious distinctions pointed out between the various groups of *Rana*. Barbour states, speaking of *Philautus pallidipes* Barbour:

The small size (body one inch long for nearly adult female), lack of cranial ossification, the absence of vomerine teeth place this form with the genus *Ixalus*. The fact, however, that two species of *Polypedates* have been discovered, viz. *P. edentulus* (F. Müller) and *P. anodon* (Van Kampen) which also lack vomerine teeth, shows how scant is the basis of separation for the two genera. Cranial ossification is unknown in *Ixalus* and, of course, is not general in *Polypedates* so that the adult size alone stands as the generic distinction. A very slim one surely.<sup>9</sup>

The Ranidæ are the so-called true frogs. They are not known to be poisonous and for the most part are edible. Many of the species are large enough to be of commercial value and are found frequently in Philippine markets. The larger species are bred on farms in various parts of the world and sell for high prices. The clear white flesh is considered a great delicacy. The manufacture of fine leather from frog skins is an industry of considerable importance in Japan.

The Philippine species which appear to attain the largest sizes are *Rana vittigera*, *R. magna*, and *R. moodiei*. Some specimens of these species in the collection have a body length of 13 centimeters and the hind legs measure 16.4 centimeters, making a total length of nearly 30 centimeters. Doubtless they grow to even larger sizes.

The largest species known in the world appears to be *Rana goliath* Boulenger, from Africa, which attains a body length of about 30 centimeters, with legs nearly 35 centimeters long, or a total of 65 centimeters (nearly 2 feet 2 inches).

*Key to the Philippine genera of Ranidæ.*

- a*<sup>1</sup>. Tongue entire; fingers free, toes webbed; tympanum indistinct; very small or no disks on digits; no vomerine teeth..... *Oxyglossus* Tschudi.  
*a*<sup>2</sup>. Tongue more or less deeply nicked behind.  
*b*<sup>1</sup>. Vomerine teeth present; fingers perfectly free; no intercalated bone between last two phalanges; toes more or less webbed; outer metatarsals separated by a web; with or without disks on tips of digits..... *Rana* Linnaeus.  
*b*<sup>2</sup>. Vomerine teeth present or absent; a small intercalated bone between last two phalanges of digits; terminal digits T-shaped; outer metatarsals separated by a web.

<sup>9</sup> Proc. Biol. Soc. Washington 21 (1908) 190.

- c<sup>1</sup>. No vomerine teeth; tympanum distinct; fingers free, toes webbed, disks large..... Staurois Cope.
- c<sup>2</sup>. Vomerine teeth usually present; fingers more or less webbed; toes webbed; disks present; skin of head sometimes involved in cranial ossification..... Polypedates Tschudi.
- c<sup>3</sup>. Vomerine teeth wanting; fingers free, toes webbed; disks present; head with bony ridges; skin of head involved in cranial ossification.  
Hazelia g. nov.
- c<sup>4</sup>. Vomerine teeth wanting; fingers free or webbed; toes webbed, disks present; skin on head not involved in cranial ossification.  
Philautus Gistel.
- b<sup>3</sup>. Vomerine teeth present; no intercalated bone between last two terminal phalanges; fingers free; toes usually free, sometimes slightly webbed; outer metatarsals united or separated by a groove; terminal phalanges T-shaped..... Cornufer Tschudi.

## Genus OXYGLOSSUS Tschudi

*Oxyglossus* TSCHUDI, Class. Batr. (1838) 35; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 332; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 6; COPE, Nat. Hist. Rev. (1865) 117; BOETTGER, Ber. Senck. Nat. Ges. (1886) 121; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 5; Fauna Brit. India, Rept. (1890) 436.  
*Microdiscopus* PETERS, Mon. Berl. Ak. (1877) 422.

"Pupil horizontal. Tongue narrow, entire, and free behind. Vomerine teeth none. Tympanum indistinct. Fingers free, toes webbed, the tips not dilated into regular disks. Outer metatarsals separated by a web. Omosternum with a bony style; sternum a cartilaginous plate. Terminal phalanges simple." (*Boulenger.*)

Three species of this genus are known, only one of which appears to enter our territory. A second is included in Casto de Elera's list, but the specimen reported to be in the Santo Tomás University collection is no longer extant.

*Oxyglossus lævis* Günther. Plate 1, fig. 1.

*Oxyglossus laevis* GÜNTHER, Cat. Batr. Sal. Brit. Mus. 7 (1858) pl. 1, fig. A; Rept. Brit. India (1864) 401; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 6; Fauna Brit. India, Rept. (1890) 437; Proc. Zool. Soc. London (1897) 228; STOLICZKA, Journ. As. Soc. Bengal (1870) 273; (1872) 101; BOETTGER, Ber. Senck. Nat. Ges. (1886) 121; BOULENGER, Ann. & Mag. Nat. Hist. VI 14 (1894) 85. *Microdiscopus sumatranus* PETERS, Mon. Berl. Ak. (1877) 422, 682.

*Description of species.*—(From No. 1236, E. H. Taylor collection; collected at Hinigaran, Occidental Negros, P. I., March, 1915, by E. H. Taylor.) No vomerine teeth; choanæ small, round, not widely separated; tongue regularly oval, rounded behind; no canthus rostralis; head broader than long; loreal



region sloping very obliquely to mouth; nostrils halfway between eye and end of snout, the distance between them greater than their distance from eye; interorbital region narrow, much less than a single eyelid; eye moderately small, its diameter less than length of snout; tympanum covered with skin, its outline dim, its diameter less than eye; skin above granular, striated, corrugated or with small tubercles; chin roughly granular, with a series of dim glandular tubercles forming two longitudinal parallel rows, which run from point of lower jaw to breast, where they meet a row of small glands, which cross the neck to near angle of mouth and go above arm to some distance on side; belly finely granular; anal region and underside of thighs granular; a straight supratemporal fold from eye to behind angle of mouth; parietal regions somewhat swollen; arms short, thick; fingers short with tips not as wide as fingers; palm with two prominent tubercles, that on first finger largest; first finger slightly longer than third or second; hind legs short and thick; toes with small disks, a little wider than toes; toes webbed to base of disks, very slightly incised between digits; subarticular tubercles small; a sharply defined inner metatarsal tubercle about one-third the length of first toe; no outer metatarsal tubercle; a skin fold on outer side of first and fifth toes, that on first toe continued on tarsus. Male with internal subgular vocal sac. The tibiotarsal articulation reaches snout.

*Color in life.*—Above black-brown, with a dull yellow stripe from snout to anus; sides lighter, mottled brown; belly, chin, and underside of legs dirty cream, more or less spotted or mottled with dark brown.

*Measurements of Oxyglossus laevis Günther.*

	mm.
Length, snout to vent	61
Length of head	19
Width of head	20.5
Length of snout	7.5
Diameter of tympanum (about)	5
Diameter of eye	6
Foreleg	27
Longest finger	11
Hind leg	93
Femur	23
Tibia	21.5
Longest toe	22

*Variation.*—The variation in color is marked; some specimens in my collection are dull reddish brown above and white below, with a few scattered markings on legs; one specimen examined is uniform gray, yellowish below; hind legs dark above, light

below, mottled and spotted darker. A Mindanao specimen is grayish, with a hair line on back with two dark stripes on each side; arms and legs barred with darker; the small tubercles on hind legs tipped with yellowish. The rows of glands on neck are scarcely visible in preserved specimens, but are distinct in living frogs.

*Remarks.*—The frogs of this species are thoroughly aquatic in habit, and are invariably found in water. They sit in the edges of the pools, only the snout and part of the head emerging. On the slightest disturbance they disappear below the surface, where they remain for a considerable time. A search among leaves and mud at the bottom of small pools often revealed specimens whose presence was only suspected. These frogs appear to be found everywhere in the Philippines. Specimens were collected by H. Otley Beyer at Banaue, Mountain Province, at an elevation of 1,800 meters. They are known from Luzon, Samar, Leyte, Mindanao, Dinagat, Basilan, Sulu Archipelago, Negros, Panay, Mindoro, Palawan, and Busuanga; also from Celebes, Borneo, Sumatra, Malay Peninsula, and Burma. The two types in the British Museum are females, both from the Philippines; the exact type locality is no longer known.

#### Genus *RANA* Linnæus

*Rana* LINNÆUS, Syst. Nat. ed. 10 1 (1758) 210; WAGLER, Nat. Syst. Amph. (1830) 203; TSCHUDI, Class. Batr. (1838) 78; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 335; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 8; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 6; STEJNEGER, Bull. U. S. Nat. Mus. 58 (1907) 93.

*Hylarana* TSCHUDI, Class. Batr. (1838) 78.

*Hylarana* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 71; Rept. Brit. India (1864) 423.

*Limnodytes* DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 510.

*Polypedates* TSCHUDI, Class. Batr. (1838) 78; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 77.

“Pupil horizontal. Tongue free and deeply notched behind. Vomerine teeth. Tympanum distinct or hidden. Fingers free; toes webbed, with simple or dilated tips. Outer metatarsals separated by web. Omosternum and sternum with a strong bony style. Terminal phalanges acute, transversely dilated or T-shaped.” (*Boulenger.*)

Widely distributed, except in the southern parts of South America and in New Zealand. Absent in Australia, except in the extreme northern part.

It has been necessary to eliminate from the Philippine list some species long regarded as occurring there, such as *Rana*



*tigerina* Daudin and *R. macrodon* Kuhl. Stejneger<sup>10</sup> recognized that the large-toothed species of the Philippines is distinct from *R. macrodon* and named it *R. magna*. *Rana vittigera* and *R. moodiei* have long been confused with *R. tigerina*, but the characters which obtain in the first two groups show clearly that they are very distinct from *R. tigerina*.

It was with great hesitancy that I united the two species, *Rana varians* Boulenger and *R. sanguinea* Boettger. I have not examined the types, but a comparison of the type descriptions shows no differences warranting separation. My opinion was confirmed by a comparison of specimens from the Calamianes and Palawan.

*Key to the Philippine species of Rana Linnæus.*

a<sup>1</sup>. No gland on upper arm.

b<sup>1</sup>. Fingers and toes not or but slightly dilated at tips; no bony teeth in lower jaw.

c<sup>1</sup>. Eyelid much wider than interorbital distance; no distinct canthus rostralis (large frog).

d<sup>1</sup>. A flap of skin on outer side of fifth toe and metatarsal.

*R. moodiei* sp. nov.

d<sup>2</sup>. No skin flap on fifth toe and metatarsal.... *R. vittigera* Wiegmann.

c<sup>2</sup>. Eyelid about equal to interorbital space.

d<sup>2</sup>. Toes almost completely webbed; skin granular (small frog).

*R. mindanensis* Girard.

d<sup>3</sup>. Toes about two-thirds webbed; a narrow dorsolateral fold.

*R. palawanensis* Boulenger.

c<sup>3</sup>. Eyelid much narrower than interorbital space; skin smooth; toes one-half webbed (small frog)..... *R. parva* sp. nov.

b<sup>2</sup>. Fingers and toes distinctly dilated into small disks, without a groove around the edge; two well-developed bony teeth in the anterior part of lower jaw. Canthus rostralis distinct, angular.

c<sup>4</sup>. Toes entirely webbed; tympanum large, distinct; dorsolateral fold sometimes present in young (large frog).

*R. magna* Stejneger.

c<sup>5</sup>. Toes about two-thirds webbed; tympanum large; dorsolateral fold usually present (rather small frog)..... *R. leytenensis* Boettger.

b<sup>3</sup>. Fingers and toes dilated into regular disks with a transverse groove around disk; no bony mandibular teeth.

c<sup>6</sup>. A broad glandular dorsolateral fold; tympanum equals four-fifths eye; canthus rostralis rounded; toes about four-fifths webbed.

*R. erythræa* (Schlegel).

c<sup>7</sup>. A narrow dorsolateral fold.

d<sup>4</sup>. First finger shorter than second.

e<sup>1</sup>. Snout truncate; finger disks large; tympanum three-fourths eye; canthus rostralis angular..... *R. mearnsi* Stejneger.

e<sup>2</sup>. Snout obtuse; tympanum about two-fifths eye; canthus rostralis angular ..... *R. dubita* sp. nov.

<sup>10</sup> Smithson. Misc. Coll. 52 (1908-10) 437.

- e*<sup>3</sup>. Snout acutely pointed; tympanum about three-fourths eye.  
*R. luzonensis* Boulenger.
- e*<sup>4</sup>. Snout rather pointed; tympanum about one-third diameter of eye; an inner and an outer metatarsal tubercle.  
*R. guerreroi* sp. nov.
- d*<sup>2</sup>. First finger equals second; toes three-fourths webbed; finger disks about one-half tympanum; snout rounded.  
*R. sanchezi* sp. nov.
- d*<sup>3</sup>. First finger much longer than second; snout obtusely pointed; tympanum more than three-fourths eye; toes four-fifths webbed.  
*R. sanguinea* Boettger.
- c*<sup>5</sup>. No dorsolateral glandular fold.
- d*<sup>1</sup>. Eyes moderate.
- e*<sup>1</sup>. First finger shorter than second; tympanum three-fourths eye.  
*R. everetti* Boulenger.
- e*<sup>2</sup>. First finger longer than second.
- f*<sup>1</sup>. Diameter of tympanum three-fourths eye; first finger not opposed to others..... *R. suluensis* sp. nov.
- f*<sup>2</sup>. Diameter of tympanum about three-fifths eye; first finger opposed to others..... *R. philippinensis* sp. nov.
- d*<sup>2</sup>. Eyes large.
- e*<sup>1</sup>. Interorbital area one and one-half times upper eyelid; tympanum about one-half eye..... *R. moellendorffi* Boettger.
- e*<sup>2</sup>. Interorbital area equals upper eyelid..... *R. similis* (Günther).
- a*<sup>2</sup>. A gland present on upper arm; tips of toes swollen into small disks.
- b*<sup>1</sup>. Diameter of eye longer than snout; upper eyelid one and one-third times interorbital distance; no dorsolateral white lines.  
*R. grandocula* sp. nov.
- b*<sup>2</sup>. Diameter of eye equals length of snout; interorbital space equals upper eyelid; eyes red..... *R. glandulosa* Boulenger.
- b*<sup>3</sup>. Diameter of eye reaches nostril; interorbital space equals upper eyelid.  
*R. melanomenta* sp. nov.

*Rana moodiei* sp. nov. Plate 1, fig. 5.

*Type*.—No. 1240, E. H. Taylor collection; collected at Manila, P. I., November, 1914, by E. H. Taylor.

*Description of type*.—Vomerine teeth in two strong oblique series, beginning on anterior inner edge of choanæ but extending a considerable distance behind them, separated from each other by a very slight distance; choanæ moderate, separated from each other by a distance a little larger than that between nostrils; no apophyses or "teeth" on anterior part of lower jaw; distance between Eustachian tubes about one-fifth longer than their distance from choanæ; length of head from angle of jaw only slightly greater than width of head at tympanum; eyes moderate, not extending to edge of outline of head when viewed from above, their diameter equal to their distance from snout; nostrils very distinctly nearer tip of snout than eye; tympanum large, distinct, about three-fourths diameter of eye; upper eyelid about one and one-half times interorbital distance; tympanum



separated from eye by a distance equal to three-fourths its diameter; loreal region sloping broadly, not concave; canthus rostralis rounded or very indistinct; skin above extremely rugose with tubercles and folds of irregular length; a skin fold across occiput behind upper eyelids continuous with the angular folds from eye to arm above tympanum; a fold on posterior part of upper lip turning down at angle of jaw; a series of dorsolateral longitudinal folds not continuous, other shorter folds on sides and back; upper part of limbs with small tubercles; belly and throat smooth; underside of limbs and posterior part of thighs smooth, except in anal region; first finger longer than second and fourth; subarticular tubercles distinct; palmar tubercles, except that on base of first finger, very indistinct; tips slightly swollen; toes not more than three-fourths webbed, the web reaching near tip of fifth and outer side of third, a distinct flap of skin on outer side of fifth; a very strong, compressed, inner metatarsal tubercle, no outer; an indistinct tarsal fold from inner tubercle; tibiotarsal articulation reaches anterior corner of eye. Males with vocal sacs.

*Color in life*.—Above brownish olive, with very indistinct darker markings; sides rather lighter, yellowish, with dense, darker reticulations; belly yellowish; large dark spots on upper labials.

*Measurements of Rana moodiei sp. nov.*

	mm.
Length, snout to vent	73
Length of head	30
Width of head	29
Diameter of eye	9.5
Diameter of tympanum	5.5
Length of snout	12
Eye to nostril	7.5
Interorbital distance	4
Upper eyelid	5.8
Foreleg	40
Longest finger	15
Hind leg	120
Femur	32.5
Tibia	34
Foot and heel	55
Longest toe	37

*Variation*.—Certain variations exist in this species. Mindanao specimens are greenish brown to brownish with darker spots, and the distance between the point of skin flap on the fifth toe to the inner metatarsal tubercle is greater than in Manila specimens. In certain specimens the skin is pulled tight

across the occiput, and the transverse fold is scarcely noticeable. In none of the specimens (there are no less than forty in my collection and that of the Bureau of Science) is there a trace of the median dorsal stripe, a stripe on the tibia, or a diagonal lateral yellowish stripe; the skin flap is universally present. Males usually have large black spots on each side of the throat, the skin of which is sometimes in folds.

*Remarks.*—This species differs from *Rana vittigera* Wiegmann in much the same manner that *R. tigerina* Daudin differs from *R. limnocharis*; that is, in the presence of the flap of skin on the fifth toe. From *R. vittigera* it also differs in having a fold of skin across the head; the head broader in proportion to length; the eyes smaller and less prominent; the nostrils nearer tip of snout; and in the absence of stripes on the body. It differs from *R. tigerina* in the absence of "teeth" in the lower jaw, the more forward position of the nostrils, and the much less extent of webbing on toes.

The species is common in Mindanao, Luzon, and Negros, and probably occurs on many other islands. It is probable that certain records of *Rana tigerina* from the Philippines are referable to this species.

The breeding season for the species in Manila begins about July 10; it breeds in the same pools as does *Rana vittigera*. I am as yet unable to differentiate the tadpoles of the two species.

The species is named for my friend and former teacher, Dr. Roy Lee Moodie, associate in anatomy, University of Illinois, Chicago, noted for his extensive researches on extinct Amphibia of North America.

*Rana vittigera* Wiegmann. Plate 2, fig. 3.

*Rana vittigera* WIEGMANN, Nova Acta Ac. Leop.-Carol. (1836) 225, pl. 21, fig. 1.

*Rana tigrina* and *Rana tigerina* of various authors in the references of this species to the Philippines.<sup>11</sup>

<sup>11</sup> It is highly probable that many of the references of *Rana tigerina* Daudin to the Philippines should be placed under this species, at least in part, since it is probable that specimens of *R. moodiei* have also been confused with it. I am confident that the Philippine specimen of *R. vittigera* Wiegmann (which was one of the types) belonged to the species here considered; the Macao specimen may be referable to *R. limnocharis*. In consequence I have resurrected Wiegmann's name. (Note distinctive characters under remarks.) My opinions regarding the treatment of this species are concurred in by Prof. S. F. Light, of the University of the Philippines, who for a number of years has used this species as well as *R. moodiei* for dissection and demonstration in his biological classes.

*Description of species.*—(From No. 1234, E. H. Taylor collection; collected at Manila, P. I., November, 1914, by E. H. Taylor.) Vomerine teeth in two oblique series beginning on anterior inner edge of choanæ and extending behind their posterior edge; tongue large, deeply notched, extensively free; (male with vocal sacs); distance between choanæ equals distance from eye to nostril; head longer than wide; snout rather pointed, tip rounded in lateral profile, slightly projecting; nostrils equidistant or slightly nearer tip of snout than eye; no canthus rostralis, the lores very slightly concave, sloping broadly to mouth; diameter of eye a little more than distance of eye to nostril; tympanum from one-half to two-thirds eye; distance from eye to tympanum equals about three-fifths the diameter of the latter; interorbital distance about half the width of an eyelid; skin above on back strongly rugose, with longer and shorter longitudinal folds, the spaces between distinctly granular; a strong angular fold from eye above tympanum to above foreleg; a short glandular fold from corner of mouth to above foreleg; sides granular, with short longitudinal folds on upper part; chin and throat smooth; belly smooth, except posterior part, which is slightly wrinkled and granular; anal region granular; fingers not, or but very slightly, swollen at tip, rather blunt; subarticular tubercles prominent; carpal tubercles indistinct; first finger extends considerably beyond second and fourth, no trace of skin fold on sides of inner fingers; toes from one-half to three-fourths webbed, the membranes failing to reach the tips, and deeply excised between digits; no free skin fringe on outer toe, but a mere indication of a skin fold; inner metatarsal tubercle small, compressed, its length about one-third that of first toe; no indication of an outer tubercle; tibiotarsal articulation reaches anterior corner of eye or slightly farther; interorbital region equals about one-half the distance between nostrils.

*Color in life.*—Above dark olive gray, with numerous, scattered, larger and smaller blackish spots on back, sides, and limbs; a prominent bar across head over posterior part of eyelids, and a prominent, broad W-shaped mark between shoulders; sides olive to yellowish brown with a dim, lighter, yellow-brown diagonal stripe from eye to near groin; axilla, underside of arm, groin, underpart of hind limbs, and upper side of foot, bright lemon to canary; belly whitish; throat dusky; lips above and below with dark spots; a loreal stripe present; underside of hand and foot rather purplish; posterior aspect of thigh black, reticulated with yellow lines.



*Measurements of Rana vittigera Wiegmann.*

	mm.
Length, snout to vent	95
Length of head, to angle of jaw	35
Width of head	30
Length of snout	15.5
Diameter of eye	10
Diameter of tympanum	6.5
Eye to nostril	7.2
Interorbital distance	4
Upper eyelid, width	7
Foreleg	45
Longest finger	17
Hind leg	154
Femur	43
Tibia	46
Foot	66
Longest toe	45

*Variation.*—There is slight variation in the amount of webbing between the toes, and the toes are never fully webbed. In young specimens the toes are more pointed at the tip, while in older specimens they are blunter and sometimes swollen. The size of the tympanum varies, but is always more than one-half the diameter of the eye. Occasional specimens have the nostrils exactly halfway between tip of snout and eye. The number and arrangement of the longitudinal folds vary with each specimen. The arrangement of the vomerine teeth is quite constant; these teeth are usually larger and stronger in older specimens.

The color varies remarkably; about two-thirds of the two hundred specimens examined had a median, dorsal, greenish yellow or white stripe, from tip of snout to anus, varying in width from a stripe of 5 millimeters to a hair line. The diagonal line on the sides is invariably evident, often bright green or yellow, frequently dull and rather obscure. The ground color varies from grayish yellow to dark blackish brown; frequently in lighter specimens the dark spots are green; other specimens show the entire back a bright green. Many specimens have a narrow yellow line from knee to heel.<sup>12</sup>

*Remarks.*—This species differs from *Rana tigerina*, with which it has frequently been confused, in the absence of the membranaceous fringe on the fifth toe; the absence of bony teeth or prominences in the lower jaw; and the lesser amount of webbing

<sup>12</sup>I am indebted to Prof. S. F. Light for several living specimens of this species, with numerous tadpoles; and for the privilege of examining a large quantity of living and preserved material at the University of the Philippines.

between the toes. Other less important differences are evident on a comparison of the two species. From *Rana limnocharis* it differs in its larger size, the more anterior arrangement of the vomerine teeth, and the absence of an outer metatarsal tubercle. They agree with each other in the absence of the fringe and the proportionally longer legs. From *Rana macrodon* and *R. modesta* Boulenger, it differs in the absence of large bony teeth, the absence of distinct disks on toes, and the lesser extent of the webbing. *Rana moodiei*, with which it is most frequently confused in the Philippines, has a membranaceous fringe on the fifth toe, but neither a dorsal nor a diagonal lateral stripe is ever present; the limbs are shorter in *R. moodiei*, the nostrils farther forward, and a fold is usually present between the posterior corners of the eyes across the head, at least in adult specimens. *Rana vittigera* is common in Luzon, and I have taken specimens in Mindoro and Negros. In the Bureau of Science collection there is a specimen from Polillo. It is found in the same localities and habitats as *R. magna* and *R. moodiei*. The breeding season at Manila begins about the first of July. The eggs are usually deposited in pools of water, left by rains.

*Tadpoles*.—Specimens of tadpoles of this species obtained July 17 measured as follows: Total length, 52 millimeters; snout to vent, 20; depth of tail fin, 10; hind legs, 11. Spiracle sinistral; distance between nostrils less than their distance from eye; nostrils nearer eye than tip of snout; mouth with short sucker-like distension; maxillary beak a heavy, regularly curved, black plate; plate in lower jaw rather angular medially; upper lip with a series of minute black teeth on its extreme outer edge, two shorter curved series, widely separated somewhat below it; lower lip rather lobulated on edge with three series of teeth on inner surface, the upper series longest, the lower shortest and widest.

*Color*.—Above greenish, with darker markings; usually a few specimens show a median lighter line on back and lateral, diagonal, yellowish green lines on sides; occasionally there is a blackish bar across interorbital region and eyelids; golden and green on sides and variegated golden on belly.

*Rana mindanensis* (Girard).

*Hylarana mindanensis* GIRARD, Proc. Acad. Nat. Sci. Philadelphia 6 (1853) 423; U. S. Expl. Exp., Herpetology (1858) 52; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 6.

*Rana mindanensis* BOETTGER, Ber. Senck. Nat. Ges. (1886) 121; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 445.

*Description of species.*—(From Girard.) “This appears to be the smallest species of its genus, the greatest length of the body and head together measuring but one inch, the head forming about the third of it, and is as long as broad. The upper surface of the head is almost flat, and, when viewed from above, ovoid in its outline. The snout is elevated, rounded, narrow, and quite prominent. The nostrils are conspicuous, and nearer the extremity of the snout than the anterior rim of the orbit. The space between the nostrils and eyes is subconcave, whilst the margin of the jaw constitutes a convex ridge. The eyes are proportionally large and prominent, subcircular in shape, their diameter being equal to the distance between their anterior rim and the extremity of the snout. The interocular space is equal to the greatest width of the upper lid, which, itself, is smooth like the surface of the head. The tympanum is situated very close to the eye, and is less in diameter than the latter. The tongue is large, fleshy, subelliptical; its posterior bifurcation being narrow and diverging. The inner nostrils are subcircular, of medium size, and situated near to the jaw-bone. The vomerine teeth are not very conspicuous, disposed upon two narrow, widely separated, elliptical groups or series, directed obliquely inwards and backwards from the posterior margin of the inner nostrils.

“The body is elongated, subcylindrical; the anterior limbs slender, shorter than the trunk; the posterior ones, comparatively well developed, longer than the body and head together, by the whole length of the foot. The fingers are subdepressed; the first is but very little longer than the second and fourth; the latter two being nearly equal. The palm of the hand exhibits ridges running in the direction of the fingers. The articulations of the latter are provided beneath with conspicuous though small knobs or tubercles, in every point similar to the swellings on the inferior surface of their extremities. The toes are webbed, very nearly to their tips, but the membrane is very deeply concave between all of them. The swellings at their extremities are larger than the tubercles under their articulations. There is but one metatarsal tubercle, situated at the base of the inner toe, from which a horny ridge extends along the inner edge of the tarsus. The exterior ridge of the fifth toe is bordered by a membranous ridge, which, however, does not reach quite to its extremity. The skin above is minutely pustulous, and smooth beneath.”

*Color.*—“The ground color is greenish-brown, uniform and lighter beneath. There are obsolete darker spots on the body



as well as on the limbs. The margin of the upper jaw and sides of the head exhibit similar traces of maculæ."

*Remarks.*—Two specimens were captured "in the Caldera, on Mindanao" near Zamboanga. Boulenger regards this as a doubtful species. It has not been rediscovered.

*Rana parva* sp. nov. Plate 3, fig. 4.

*Type.*—No. F409, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., August, 1912, by E. H. Taylor.

*Description of type.*—Vomerine teeth in two elongate, oblique, converging series, beginning on inner side of choanæ and extending much beyond hinder level of choanæ, narrowly separated medially; choanæ small, rather hidden under edge of jaw; tongue oval, very slightly notched behind, the "horns" only slight rounded knobs, widely separated at their base; head and body flat above, head about as wide as long; eye distinctly less than length of snout; tympanum distinct, its diameter about two-thirds that of eye; nostril much nearer end of snout than eye; tympanum separated from eye by a distance equal to one-half its diameter; interorbital width one and one-half times upper eyelid; canthus rostralis distinct, rounded; loreal region with slight oblique slope; a slight depression behind nostrils, distance between nostrils much greater than their distance from eyes; skin on back smooth; on snout, sides, and upper side of limbs skin with numerous minute rounded depressions; chin, throat, and belly smooth; a very slight supratemporal fold above tympanum to near arm; no dorsolateral fold; fingers very slender, widened at tips into very small disks, slightly wider than the digits themselves; first finger distinctly longer than second, slightly longer than fourth; no skin fold on outer finger or on arm; toes one-third to one-half webbed, third toe barely longer than fifth; disks of toes slightly larger than those on fingers; subarticular tubercles moderate; an elongate, oval, inner metatarsal tubercle, more than a third the length of first toe; no outer tubercle visible; no tarsal fold; tibiotarsal articulation reaches nostril.

*Color in life.*—Above uniform reddish brown on back, snout, and head, with very indistinct darker areas interorbitally and between shoulders; sides of head and body darker brown than back, becoming almost black along the straight dorsolateral limit of the ground color of back, forming a distinct contrast; the ventrolateral area much lighter, with small yellowish spots; belly cream, chin densely powdered with cinnamon brown; arms and limbs brown, lightly barred with darker brown.

Measurements of *Rana parva* sp. nov.

	Type. mm.	Cotype. mm.
Length of head	10.5	10
Width of head	10.1	10.2
Diameter of eye	3	3
Diameter of tympanum	1.8	2.1
Depth of snout, in front of eye	3.3	3.3
Length of snout	4.2	4.2
Foreleg	15.5	15.5
Longest finger	6	5.9
Hind leg	47	46
Femur	14	14
Tibia	16	16.5
Longest toe	13.5	13

*Variation*.—A third specimen in my collection agrees fairly well in proportions with the other two, but is smaller. In this specimen the following differences in markings are evident: The ground color of the back is much lighter along the dorsolateral line; the sides are lighter with only a narrow dark line along the upper part; the chin and underside of limbs are somewhat more densely powdered with brown.

*Remarks*.—Three specimens are in my collection. They were taken in low mountains near Bunawan, Agusan, Mindanao. They may be related to Girard's species *Rana mindanensis*,<sup>2</sup> of Mindanao, but they differ from it in a few essential points. In *R. mindanensis* the eyelid equals the interorbital region, and the toes are entirely webbed; the coloration also is different. Other differences are evident on a comparison of the two descriptions.

*Rana palavanensis* Boulenger.

*Rana palavanensis* BOULENGER, Ann. & Mag. Nat. Hist. VI 14 (1894) 85; Proc. Zool. Soc. London (1897) 230.

*Description of species*.—(From Boulenger.) "Vomerine teeth in two short oblique series commencing on a line with the hinder edge of the choanæ. Head moderate, as long as broad; snout short, rounded, as long as the diameter of the orbit; canthus rostralis angular; loreal region slightly concave; nostril equidistant from the orbit and the end of the snout; interorbital space as broad as or a little narrower than the upper eyelid; tympanum distinct, three-fifths the diameter of the eye. Fingers moderate, the tips swollen or dilated into very small disks; first finger extending slightly beyond second; toes moderate, two-thirds webbed, the tips dilated into small but very distinct disks; sub-articular tubercles moderate; inner metatarsal tubercle elliptical, flat, measuring two-fifths or one-half the length of the inner toe;

no outer metatarsal tubercle; no tarsal fold. Tibio-tarsal articulation reaching the tip of the snout or beyond; tibia as long as or a little shorter than the fore limb. Skin nearly smooth; posterior half of upper eyelids warty; a fold from the eye to the shoulder; a narrow glandular dorso-lateral fold, beginning behind the upper eyelid, above the supratemporal fold."

*Color*.—"Brown or greyish brown above; sides of snout below the canthi blackish or dark grey, with some more or less distinct dark vertical bars on the lip; supratemporal and dorso-lateral folds edged with dark brown or black on the outer side; a dark crossbar between the eyes and a dark  $\wedge$ -shaped interscapular marking usually present; limbs with regular dark cross-bands; lower parts whitish, uniform, or throat and breast spotted with brown. Male with internal vocal sacs.

"From snout to vent 43 millim."

*Remarks*.—The types are from Palawan where they were collected by A. Everett. Later the species was discovered by the same collector on Mount Kinabalu, Borneo, and in Celebes. The types are females and consequently have no vocal sacs. Specimens of males taken in Celebes had vocal sacs. In Celebes the species has been taken at an elevation of 4,000 feet. The species appears to be closely related to *Rana leytenensis* Boettger, but that species lacks the dorsolateral fold present in *R. palawanensis*. According to Boulenger, it is related also to *R. modesta* Boulenger, *R. dorix* Boulenger, *R. limborgii* Sclater, and *R. hascheana* Stoliczka.

*Rana magna* Stejneger. Plate 2, fig. 2.

*Rana magna* STEJNEGER, Smithsonian. Misc. Coll. 52 (1908-10) 437.

*Description of species*.—(From No. 28, Bureau of Science collection; collected on Polillo Island, P. I., October, 1909, by C. Canonizado.) Vomerine teeth in two large, oblique, strongly denticulated series, arising from the anterior inner edge of the choanæ, but their greater length lies behind the posterior edge; separated from each other by a distance less than one-half the length of a single series; two strongly raised, transverse, bony ridges behind choanæ, separated from each other by a distance equal to two-thirds that between choanæ; vomerine teeth barely extend to their anterior level; this latter distance equal to distance of nostril to eye; tongue very large, cordiform; Eustachian tubes as far from each other as from choanæ; two large mandibular teeth on the anterior part of lower jaw, fitting into the depressions in upper jaw; head very slightly longer than broad,



occipital region rather rugose; snout smooth and flat, except in front of nostrils, which slope very slightly to tip; end of snout high, vertical; canthus very strongly defined, angular to tip; upper part of loreal region vertical, lower part sloping broadly, making the region behind nostril distinctly concave; eye moderate, its diameter reaching a little beyond nostril; nostril about one-fourth nearer tip of snout than eye; tympanum small, its outer edge moderately distinct, about one-half the diameter of eye, separated from eye by a distance one and one-fourth times its diameter; interorbital distance a little greater than width of upper eyelid; skin above rough, tuberculated; a very strong fold from eye to above arm, above tympanum; a short, distinct, glandular fold behind angle of mouth, an elongate fold behind eye curving inward; two strong tubercles on occipital region; two large tubercles on shoulders, behind which are three large tubercles on each side of back; skin of posterior part of body finely granulate, interspersed with numerous larger tubercles; posterior part of eyelid strongly tubercular; indications of a fold between posterior parts of interorbital region; sides strongly tubercular; loreal region tubercular; skin below smooth or finely granulate, wrinkled in posterior part of belly, smooth on posterior part of limbs; first finger longer than second but slightly shorter than fourth, second and third fingers with distinct skin folds on inner side and dim ones on outer side; subarticular tubercles large, round, blunt; tips of fingers swollen into small rounded pads; a prominent tubercle at base of first finger; toes webbed fully, the membrane reaching tip of pad on outer side of first, second, and third toes, and to base of terminal pads elsewhere; pads on toes a little larger than those on fingers; a cutaneous flap on outer part of first toe extending to inner metatarsal tubercle, another on fifth toe interrupted near the middle; inner metatarsal tubercle strong, oval, about half the length of first toe; no outer tubercle; no dorsolateral fold; tibiotarsal articulation reaches nostril or a little beyond; a rather indistinct tarsal fold; distance between nostrils a little less than their distance from eye, greater than their distance from mouth, and slightly less than width of upper eyelid.

*Color in alcohol.*—Above brown of varying darker and lighter shades; snout somewhat lighter, with an indistinct darker band between eyes; region below and behind eye lighter than loreal region; lower lip spotted and mottled with black; limbs with darker markings, not forming bars; posterior part of limbs dark, reticulated with yellowish brown; below dusky, variously mottled and reticulated with darker; heels and soles of feet dark brown.

*Measurements of Rana magna Stejneger.*

	mm.
Length, snout to vent	130
Length of head, from angle of jaw	58
Width of head, at tympanum	53
Length of snout	22
Diameter of eye	14
Eye to nostril	13
Distance between nostrils	10
Tympanum	7
Eye to tympanum	9.1
Upper eyelid	11
Interorbital distance	13
Foreleg	67.5
Longest finger, from base of palm	33
Hind leg	164
Femur	70
Tibia	60
Foot	89
Longest toe	64

*Variation.*—The collection of the Bureau of Science contains specimens of this species; my own collection also contains specimens from various localities. The young, like the young of *Rana macrodon*, differ rather markedly from the adult. In *R. magna* the upper eyelid is broader than the interorbital distance; the tympanum is distinct and not as far from the eye; the tubercles and folds on body are less numerous; there is a rather distinct broken dorsolateral fold from eye to above groin (rarely continuous), and there are other shorter longitudinal folds on the sides; the webs on the feet are somewhat excised between the toes; the disks on the fingers are slightly more distinct; the tibiotarsal articulation reaches variously from eye to tip of snout; the dorsolateral fold is separated from the supratympanic fold. The body above is dark brown of varying shades, sometimes with darker spots; groin strongly marked with black; the youngest specimens usually have a strong, dark brown temporal spot; labials with large brown spots which are continuous on both upper and lower jaws; posterior part of limbs dark, mottled with yellow and white; usually a loreal stripe present.

In the adult specimens the length of the first and fourth fingers varies somewhat. Occasionally the first is longer than the fourth, frequently shorter; the toes are frequently fully webbed, the membrane reaching more than halfway on the toe disks or pads; the large teeth of the females are low, and not prominent as in the males; males invariably have small vocal sacs, the openings being rather small, back and near the angle of

the mouth; the arrangement of the vomerine teeth varies considerably, beginning sometimes on the anterior inner edge of the choanæ, sometimes at some distance from them, sometimes in advance of the anterior level, sometimes nearer the hinder level, or they may extend to or behind the transverse palatine ridges.

*Remarks.*—I have no doubt that the specimens are correctly referred to this species. All have small vocal sacs, a character which is not mentioned by Stejneger in his specimens. Boulenger states that *R. modesta* is a smaller species than *R. macrodon*. It is possible that he had not examined the largest specimens. Stejneger compares his specimens with *R. macrodon* only and makes no mention of its relation to *R. modesta* Boulenger.

*Rana magna* is the largest of the Philippine frogs. Specimens are found in the immediate vicinity of water, usually along the banks of small mountain streams or about pools. When disturbed they at once take refuge in the water. Their eggs are deposited in water. Eggs taken from the ovary of a female in the Bureau of Science collection measured 2.5 millimeters in length.

*Rana leytenensis* Boettger. Plate 2, fig. 1.

*Rana leytenensis* BOETTGER, Zool. Anz. 16 (1893) 365; BOULENGER, Proc. Zool. Soc. London (1897) 229.

*Description of species.*—(From No. 1040, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., 1912.) Vomerine teeth in two oblique series, arising from the inner edges of the choanæ, but lying for the most part behind them, separated from each other by a distance about half the length of a single group; two distinct, enlarged, sharp teeth in anterior part of lower jaw; choanæ not large, distance between them equal to distance of nostril from eye; head longer than wide, the canthus rounded angularly; snout rather rounded; upper part of loreal region nearly vertical, lower part obliquely sloping, leaving the lores concave; nostril one and a half times farther from eye than end of snout; distance between nostrils equals their distance from eye; eye large, more than four-fifths the length of snout; tympanum large, distinct, about one-half the size of eye, separated from eye by a distance about one-half its diameter; interorbital region equal to width of a single eyelid; skin on anterior part of body above smooth, with longitudinal folds of unequal length; an inverted V-shaped fold in middle of back; the most prominent folds are dorsolateral, beginning behind eye, and not continuous with the very distinct supratympanic fold which continues to near insertion of arm; posterior part of body with tubercles,



some large, some very small; tibia and foot also minutely tubercular; sides rough, with short longitudinal folds and tubercles; belly, throat, and underside of limbs entirely smooth; posterior aspect of thigh rather granular; a few small glandular folds above arm and at angle of jaw; fingers elongate, rather slender, with distinct, though small, disks without transverse grooves; first and second fingers equal, reaching first subarticular of third; fourth longer than first two; subarticular tubercles prominent; a prominent tubercle at base of first finger, two indistinct ones on palm; inner side of second and third fingers with distinct skin fold; toes elongate, slender, with disks, about two-thirds webbed; membrane reaches base of disk on second and third toes on outer side, but not on inner, and to base of disk on inner side of fifth; on fourth toe the web reaches first outer subarticular tubercle, and continues to disk as two narrow margins; fifth toe reaches second outer tubercle, and third toe reaches first subarticular tubercle of fourth; a distinct, elongate, oval, inner metatarsal tubercle more than one-third the length of first toe; no outer tubercle; a skin flap on outer side of fifth toe; a very slight skin fold continues behind inner metatarsal tubercle; tibio-tarsal articulation reaches to near nostril. Males with internal vocal sacs, the slitlike opening conspicuous on either side and somewhat behind tongue.

*Color in life.*—Above dark olive brown with a blackish stripe across head over eyelids; folds and tubercles usually slightly darker in color; sides brownish, with a black tympanic spot and a few scattered darker spots on sides; loreal region dark; limbs indistinctly barred with darker; posterior part of limbs dark, mottled with yellowish; belly cream, with dusky markings on throat and under thighs; palms and soles slate color.

*Measurements of Rana leytensis Boettger.*

	mm.
Length, snout to vent	48
Width of head	17
Length of head	18.5
Length of snout	8
Diameter of eye	6.8
Diameter of tympanum	3.5
Foreleg	29.5
Longest finger	12.5
Hind leg, from vent	74.5
Femur	21
Tibia	21.5
Foot	34.5
Longest toe	22.5
Toe disk	1.2

*Variation.*—In the collections studied there are four groups of specimens: from Polillo; from southern Sulu Archipelago; from Zamboanga, Mindanao; and from Bunawan, Agusan. These may be separated easily, as they all differ from each other more or less.

The Polillo specimens (in alcohol) are lighter brown above, showing two yellowish brown stripes from eye to end of body. The stripes on the legs are distinct, but the temporal spot is sometimes dim or wanting; behind the V-shaped mark the large granules, or tubercles, are arranged roughly in two parallel rows, which continue backward to end of body. The skin folds on inner fingers are distinct; the enlarged teeth are prominent in males and females; eggs in the belly of females measure 2 millimeters in length. The large teeth in the lower jaw are dim or wanting in individuals of the size of Boettger's type specimens, 28 millimeters.<sup>13</sup>

The Mindanao specimens resemble the Polillo forms; many of them, however, have the anterior part of the head yellowish brown in front of the transverse blackish line, and many have the belly spotted brown. The webbing of the feet and the proportionate length of the digits are exactly the same as in the Polillo specimens.

The specimens from the islands about the southern end of Tawitawi are very dark, almost slatish black above, the band scarcely distinguishable from the body color; the anterior part of head is lighter; the web between toes reaches to second tubercle of fourth toe, leaving three joints free; the membranes fail to reach disks, save as very narrow skin folds; the skin fold on fifth toe is slightly narrower; the first finger is longer than second by half the length of disk, and the skin fold on inner fingers is less distinct; the inverted V-shaped fold is present, but the double row of pustules behind is wanting.

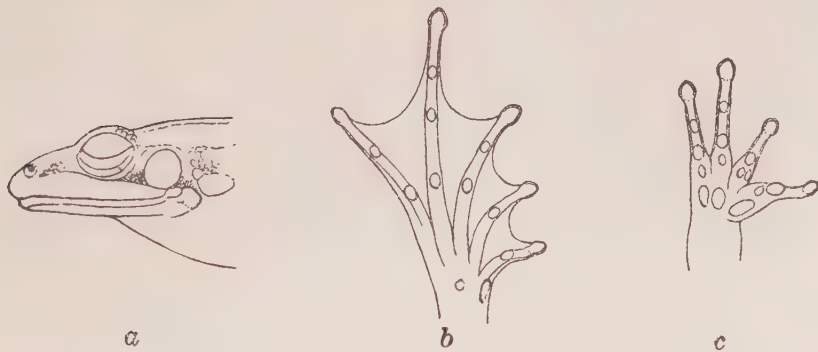
*Remarks.*—The type was collected by José Quadras and the locality given is "Island of Leyte." The species is known also from Polillo, Mindanao, Tawitawi, Bongao, and Papahag, in the Philippines. Boulenger reports the species from several localities in Celebes, and from Sandakan, North Borneo.

Specimens are found invariably in the immediate neighborhood of water, usually along streams. I have not been able to recognize their tadpoles.

<sup>13</sup> Boettger does not mention this character in his description, nor does Boulenger in his notes.

*Rana erythræa* (Schlegel). Plate 1, fig. 2.*Hyla erythræa* SCHLEGEL, Abbild. Amphib. (1837) 27, pl. 4, fig. 3.*Limnodytes erythræus* DUMÉRIE and BIBRON, Erp. Gén. 8 (1841) 511; CANTOR, Cat. Mal. Rept. (1847) 141; Journ. As. Soc. Bengal 16 (1847) 1062.*Hylarana erythræa* TSCHUDI, Class. Batr. (1838) 78.*Hylarana erythræa* GÜNTHER, Rept. Brit. India (1864) 425; STOLICZKA, Proc. As. Soc. Bengal (1872) 104; ANDERSON, Zool. Yunnan 846; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 65; FISCHER, Jahrb. Wiss. Anst. Hamburg 2 (1885) 80.*Hylarana subcærulea* COPE, Proc. Acad. Nat. Sci. Philadelphia (1868).*Rana erythræa* BOULENGER, Proc. Zool. Soc. London (1897) 231; BARBOUR, Mem. Mus. Comp. Zool. Harvard Coll. 44 (1912) 67.

*Description of species.*—(From No. 858, E. H. Taylor collection; collected at Hinigaran, Negros, P. I., October, 1915, by E. H. Taylor.) Vomerine teeth in two transverse, oblique, converging series, arising near the anterior inner edge of choanæ, and extending somewhat behind their hinder level, separated from each other by a distance equal to the length of a single

FIG. 1. *Rana erythræa* (Schlegel). a, side of head; b, foot; c, hand.  $\times 1$ .

group; choanæ small, partly hidden under edge of jaw; tongue notched deeply behind, forming two rather long horns; head elongate, nearly one-fourth longer than wide; snout rather pointed, one and one-half times diameter of eye; nostril nearer end of snout than eye; tympanum large, distinct, rounded, its diameter about four-fifths that of eye, separated from eye by a distance slightly more than half its diameter; interorbital region equal to the width of an upper eyelid; distance between nostrils equals their distance from eyes; skin above on back granular, on head smooth, no granules on upper eyelids; snout high, projecting over lower jaw; canthus rostralis rounded; loreal region nearly vertical, a deep groove behind nostril on lores; a broad dorsolateral



glandular fold from eye to end of body; upper lip thickened, appearing like a glandular fold, continuing somewhat beyond angle of mouth; another elongate glandular fold above arm, continuing brokenly along side; sides strongly granular; chin, throat, and belly perfectly smooth; posterior aspect of thighs strongly granular; tibia with very narrow, dim, longitudinal folds above; first finger extending farther than second and slightly shorter than fourth; fingers provided with small, longitudinally oval pads, much larger than subarticular tubercles, which are distinct; disks with grooves around edges; no skin fold on forearm or outer finger; toes about three-fourths to four-fifths webbed, the web reaching disks on outer sides of toes except fourth and touching disk also on inner side of fifth; web reaches last subarticular tubercle on fourth toe; no skin fold on outer side of fifth toe or on tarsus; a small inner metatarsal tubercle, no outer tubercle; disks on toes slightly smaller than on fingers; tibiotarsal articulation reaches to between eye and nostril.

*Color in life.*—Above bright olive to yellow-green, with two golden to cream yellow stripes covering the dorsolateral glandular folds; a slight, dark brown line borders the yellow stripe on its inner side, and a wider, more distinct blackish stripe below it from eye to end of body; a dark loreal streak and a dark area in front of tympanum; latter golden brown; upper lip creamy yellow, the stripe continuing to the ground color; below cream, with a wash of canary, posterior aspect of thighs brownish, mottled and spotted with darker; no bars on limbs; dark color arranged in longitudinal lines on femur and tibia; web between toes yellowish, dusky spotted.

*Measurements of Rana erythræa (Schlegel), Nos. 858 and 860.*

	mm.	mm.
Length, snout to vent	62	64
Length of head	24	25
Width of head	19.8	20.8
Diameter of eye	6.2	7.5
Length of snout	10.2	10.8
Diameter of tympanum	5.3	6
Depth of snout, in front of eyes	6.8	7
Foreleg	40	42.5
Longest finger	18	21
Hind leg	107	122
Femur	31	35
Tibia	33	38
Longest toe	31	39

*Variation.*—No great amount of variation is observable. In certain specimens the eyelid is slightly wider than the inter-orbital region; in other specimens the belly and the underside of the limbs are distinctly marked with dusky spots. The longitudinal arrangement of the brown color on the legs is apparently invariable.

*Remarks.*—This frog, which I failed to find in Mindanao, was incredibly numerous in central Negros. In the rice fields, where they spawn, the young appear in countless numbers during the latter part of the rainy season. When the dry season begins they collect around pools. My collector brought in more than a hundred specimens taken from a shallow disused well near Hinigaran, Occidental Negros. Only a few of these were preserved.

The species is known in the Philippines from Negros and, according to Fischer, from southern Mindanao. It is widely distributed and is known from Celebes and Borneo, through Sumatra and Java, to the mainland of southeastern Asia. The distribution in the Philippines would appear to be localized. It has not been discovered in Palawan, and careful search has failed to reveal it in Sulu.

*Rana mearnsi* Stejneger. Plate 4, fig. 4.

*Rana mearnsi* STEJNEGER, Proc. U. S. Nat. Mus. 28 (1905) 343.

*Description of species.*—(From No. 855, E. H. Taylor collection; collected on Canlaon Volcano, Negros, P. I., at an ele-



FIG. 2 *Rana mearnsi* Stejneger. a, side of head; b, top of head; c, hand; d, foot.  $\times 1$ .

vation of about 900 meters, December 24, 1915, by E. H. Taylor.) Vomerine teeth in two short, somewhat oblique, well-defined

series, beginning anterior to posterior level of choanæ, and separated from each other by less than one-third the length of a single group, and from the choanæ by a distance equal to nearly the length of a single group; choanæ large; tongue elongate, deeply notched behind; head low, flat, practically same depth at tympanum as at nostril; canthus rostralis distinct, angular; upper part of lores vertical, lower part sloping obliquely; a slight depression behind nostril; eye large, its diameter reaching slightly beyond nostril; distance of nostril from end of snout contained in distance from eye to nostril about four times; eyes prominent, the interorbital distance equal to the width of an upper eyelid; tympanum large, nearly three-fourths diameter of eye, separated from eye by a distance equal to half its diameter; head much longer than wide; skin of body smooth above, on limbs and sides; below, chin and anterior part of belly smooth; posterior part and under thighs strongly granular; a distinct dorsolateral fold from eye, rather narrow; a very slight fold behind tympanum, continuous with the dorsolateral fold; upper eyelids without granules; limbs slender; fingers slender, with greatly widened disks, the disks with grooves around edges, disk of first finger not larger than subarticular tubercles; first finger shorter than second, the disk reaching a little beyond base of disk of second, latter shorter than fourth, which reaches some distance beyond outer subarticular tubercle of third; toes slender, almost fully webbed, the membranes reaching base of disks, except on fourth toe; here the membrane reaches first subarticular tubercle and then continues as a very narrow margin to disk; subarticular tubercles well developed; disks of toes larger than disk of first finger, that of fifth toe smallest, prominent; inner metatarsal tubercle present, a very small outer tubercle; a very slight fold along fifth toe and along tarsus; no free flap on outer edge of fifth toe; tibio-tarsal articulation reaches a considerable distance beyond tip of snout.

*Color in life.*—Above uniform reddish to lavender brown; sides, loreal region, and about tympanum, lavender; a whitish streak from tip of snout to groin; throat dusky; belly yellowish cream; a few lavender spots under thigh; limbs very dimly barred with darker; small white spots on digits at base of disks.



*Measurements of Rana mearnsi Stejneger.*

	mm.
Total length, snout to vent	58
Length of head	22
Width of head	18.4
Length of snout	9
Eye to nostril	6.5
Diameter of eye	7.7
Diameter of tympanum	4.3
Depth of snout, in front of eye	6
Foreleg	40
Longest finger	20.2
Finger disk	4
Hind leg	111
Tibia	34
Femur	30
Longest toe	31.5
Toe disk	2.5
Foot and heel	45

The description here given differs from the type description as follows: Vomerine teeth only partially behind choanæ; interorbital distance equal to upper eyelid; tympanum more than one-half, but less than three-fifths, diameter of eye; distance of eye from nostrils a little less than diameter of eye; disks on fingers not pointed anteriorly; no pustules on eyelids or above tympanum; color obviously different.

Three specimens in my collection from Bunawan also differ from the type in a few characters: Tympanum about five-sixths the diameter of eye; interorbital distance greater than upper eyelid; disks of fingers appearing pointed and somewhat smaller than in the Negros form. The last character may be due to the preserving fluid, as the specimens are somewhat hardened. They differ markedly from the type in coloration; two are dark brown above, whitish below, and the third is brownish gray; only one specimen shows two white areas below the anus; the V-shaped mark is evident in two specimens, the dorsolateral streak is wanting in all. The snout in all the specimens is not so truncate as in the Negros form. A specimen in my collection from Baguio, in a rather poor state of preservation, apparently belongs to this species; the snout is even more truncate than in the Negros specimen; the body is grayish above, and the posterior part of

the legs is uniform brownish; the vomerine teeth are in two very small, almost transverse, groups, lying largely in front of the posterior border of the choanæ.

In the proportions of the legs, the webbing of the toes, and the general contour these specimens are almost identical. I believe we have to do with only a variable form and not with different species; the Bunawan specimens are from a place less than 80 kilometers from the type locality.

*Remarks.*—The specimens were all found along small mountain streams, usually under small plants growing on the rocks. They are not uncommon at Bunawan, but are difficult to capture. Many other specimens taken were lost before they could be studied. The type was collected on Baganga River, Davao, Mindanao, by E. A. Mearns.

*Rana luzonensis* Boulenger.

*Rana luzonensis* BOULENGER, Ann. & Mag. Nat. Hist. VI 17 (1896), 401.

*Description of species.*—(From Boulenger.) “Vomerine teeth in two oblique groups between, and extending beyond, the posterior borders of the choanæ. Snout much depressed, acutely pointed, projecting, longer than the diameter of the orbit; canthus rostralis strong; loreal region feebly oblique, grooved; nostril nearer the end of the snout than the eye; interorbital space as broad as the upper eyelid; tympanum very distinct, two-thirds to three-fourths the diameter of the eye. Fingers long and slender, first a little shorter than second, dilated into large disks. Toes webbed to the disks of the third and fifth, to the penultimate phalanx of the fourth; disks smaller than those of the fingers; subarticular tubercles strong; a small oval inner metatarsal tubercle. The tibio-tarsal articulation reaches far beyond the tip of the snout. Skin smooth; a feeble narrow dorso-lateral glandular fold.”

*Color.*—“Greyish or olive above, with or without a light vertebral line; a blackish canthal streak and temporal spot; tympanum reddish brown; upper lip with a light, dark edged streak; limbs with dark cross-bands; whitish beneath, throat and breast sometimes brown.

“From snout to vent 58 millim.”

*Remarks.*—This little-known species was discovered in the highlands of Lepanto, Luzon, by John Whitehead. Four specimens were taken, female and half grown. It has not been rediscovered.

*Rana guerreroi* sp. nov.

*Type*.—No. 881, E. H. Taylor collection; collected at Baguio, Mountain Province, Luzon, P. I., June 1, 1915, by E. H. Taylor.

*Description of type*.—(Young.) Vomerine teeth in two small, rounded, transverse groups between posterior parts of choanæ, separated from choanæ by a distance twice as great as their distance from each other; distance between choanæ about equal to distance between nostrils; head much longer than broad; snout sloping from eye to tip in lateral profile, rather pointed anteriorly; nostril very much nearer tip of snout than eye; eye large, its diameter equal to nearly four-fifths the length of snout; lores slightly concave, nearly vertical; tympanum small, fairly distinct, about one-third of eye, not as large as finger disks, separated from eye by a distance equal to two-thirds its diameter; distance between nostrils greater than interorbital space; interorbital space one and one-half times upper eyelid; skin on body and limbs above and below smooth; anal region and posterior part of thigh partly granular; a very indistinct trace of dorsolateral skin fold, and another very dim fold above tympanum, not conjoined; fingers slender, the three outer with large, well-developed disks, first finger shorter than second, with a very narrow disk, fourth much longer than second, reaching base of disk on third; disks truncate or slightly rounded anteriorly, with distinct grooves around their edges; subarticular tubercles well developed, carpal tubercles dim; toes almost fully webbed, the membrane reaching outer base of disks on first, second, and third, and inner edge of fifth, and to near outer subarticular tubercle of fourth; third and fifth toes equal, reaching outer subarticular tubercle on fourth; rather large inner metatarsal tubercle and a small outer tubercle; hind leg brought forward, the tibiotarsal articulation reaches much beyond tip of snout.

*Color in life*.—Dark blackish brown above, lighter on sides, with indications of a dim dorsolateral lighter stripe; arms and legs light yellowish drab, barred with numerous darker stripes; belly yellowish white, flecked with dusky; posterior part of thighs and groin yellowish cream.

The species is named for Dr. L. M. Guerrero, of the Bureau of Science, Manila.



*Measurements of Rana guerreroi sp. nov.*

	mm.
Length, snout to vent	27
Length of head	11
Width of head	9
Diameter of eye	4
Diameter of tympanum	1.4
Length of snout	5
Foreleg	17.8
Longest finger	8.2
Hind leg	46.5
Femur	73
Tibia	16
Foot	20
Longest toe	12
Finger disk	1.5
Toe disk	1

*Variation.*—The nineteen specimens in my collection are all young, most of them having just completed their transformation; several still have tail buds, and one specimen, poorly preserved, is a tadpole. They vary from dark to light above, some showing rather distinct dorsolateral glandular folds and a fold above the tympanum; the limbs are lighter than the rest of body and are barred more or less distinctly.

*Remarks.*—I have endeavored to refer this group of specimens to some known species, but have failed to do so to my satisfaction. The characters recorded will serve to identify the adult.

The species differs from *Rana luzonensis* Boulenger in having a very much smaller tympanum, and in the presence of an outer metatarsal tubercle and a supratympanic fold, the latter separate from the dorsolateral glandular fold.

The specimens were taken along small streams near Baguio, usually under rocks or bits of wood, though frequently at some distance from water.

*Rana sanchezi sp. nov.*

*Type.*—No. F38, Bureau of Science collection; collected in the extreme northern part of Palawan, P. I., April, 1918, by E. H. Taylor.

*Description of type.*—Vomerine teeth in two slender oblique series, arising between the choanæ at a distance from their inner edge equal to about one-third the length of one group; they fail to reach farther forward than the middle of the choanæ, and their greater part lies behind the posterior border; separated from each other by a distance a little less than the length of one series; distance between Eustachian tubes equals their distance from choanæ; distance between choanæ much greater than

distance between nostrils and equal to distance between eye and nostril; head much longer than wide; diameter of eye equal to its distance from nostril; nostril one-third nearer end of snout than eye; tympanum large, its diameter more than two-thirds eye; distance from eye equal to a little more than one-third its diameter; interorbital distance about equal to width of eyelid; snout slightly depressed between nostrils; canthus rostralis distinct, angular; snout rather rounded in front, sloping downward in front of nostrils; loreal region concave, the upper part nearly vertical; skin above finely granular, the granules less distinct on upper part of limbs and eyelids and wanting on snout; a strong, well-defined dorsolateral glandular skin fold from eye to end of body; fold behind tympanum wanting or very obscure; a distinct white glandular fold behind angle of mouth to above arm, broken medially; sides finely granular; throat, chin, and belly entirely smooth; posterior part of thigh granular; also granular about anal region; first and second fingers equal, both distinctly shorter than fourth; fingers with well-defined disks, the largest disk not more than one-half tympanum; disks on first and second fingers equal, smaller than those on third and fourth; subarticular tubercles large, rounded; an elongate tubercle at base of first finger; very slight skin folds on inner sides of second and third fingers; toes about three-fourths webbed, the membrane reaching to base of disk on outer side of second and third, inner side of fifth, and midway between first and second subarticular tubercles of fourth; third toe extends as far as fifth, both reaching halfway between first and second tubercles of fourth; disks on toes a little smaller than those on fingers and slightly more pointed; a very small inner metatarsal tubercle, not more than one-sixth the length of first toe; a small, dim outer tubercle; tibiotarsal articulation reaches tip of snout; no skin, but a very indistinct skin fold along fifth toe and metatarsal; disks of toes and fingers with strong grooves around edges. Males with vocal sacs.

*Color in life.*—Above bronzy to olive brown with very small, indistinct darker flecks and marblings; canthus rostralis and dorsolateral fold silver-gray, a dark loreal stripe continuing to behind tympanum; tympanum lighter brown; lip rather glandular, with a greenish to yellowish white, narrow, regular stripe continuing to insertion of arm; upper part of sides similar to back; belly silvery white; lower lip rather dark, with a dim spot at base of arm; limbs same as back, with very indistinct barring; black spots on disks of outer fingers; posterior part of thigh reticulated with yellowish.

Measurements of *Rana sanchezi* sp. nov.

	mm.
Length, snout to vent	49
Length of head	19
Width of head	14
Length of snout	9.2
Eye to nostril	5.5
Diameter of eye	6.5
Diameter of tympanum	4.4
Interorbital distance	4.1
Foreleg	32
Longest finger	14.2
Finger disk, largest	2
Hind leg	82
Femur	21
Tibia	26
Foot	36.5
Longest toe, with metatarsal	24
Toe disk, largest	1.9

*Variation.*—A specimen was taken on Lubang Island, north of Mindoro; one on Busuanga, Calamianes; and several in northern Palawan. The Lubang specimen is a young female. In color markings, both above and below, the specimen is practically the same as the type save for the following variations: The Lubang specimen has a slightly lighter line following the dorsolateral glandular fold which continues on canthus rostralis; disks on first and second fingers about equal, very much smaller (nearly half) than those on third and fourth fingers; membranes between fingers more deeply excised, reaching disks by a rather narrow margin; the broken white glandular fold from mouth to above arm prominent; no traces of bars on legs. The Busuanga specimen (31 millimeters) is slightly larger than the Lubang specimen; its sides are darker than in the type and its back is a little lighter and marbled indistinctly with darker; the fifth toe extends very slightly farther than third; no trace of bars on hind or front legs. In one of the Palawan specimens the first toe extends very nearly as far as the second; two specimens are lavender, with darker markings, and the bars on the legs are extremely dim or wanting.

*Remarks.*—Specimens were taken along streams in low mountains. For the most part they were found perched on leaves of vines or plants, or on the bark of trees near the water, in which they immediately took refuge. *Rana sanguinea* was found in similar places.

The species is closely related to *Rana sanguinea*, and young specimens are very much alike in habitus. They are clearly differentiated by color and markings, the strongly defined,



definitely limited temporal spot being very characteristic of *R. sanguinea* Boettger, as is also the long first finger, which extends considerably beyond the second and fourth fingers. In like manner this species also differs from *R. varians* Boulenger, which I regard as identical with *R. sanguinea*. The toe and finger pads of this new species are more truncate than in *R. sanguinea*, and numerous other differences are evident on a comparison of specimens or of descriptions.

From *Rana everetti*, *R. sanchezi* differs in having smaller disks on digits (disks on toes and fingers are nearly same size) their diameter less than one-half of tympanum; the toes are not fully webbed, and there is present a distinct dorsolateral glandular fold, but no separate temporal fold above tympanum. From *R. luzonensis* it differs in having shorter limbs, the skin granular above, and in the presence of an outer metatarsal tubercle. It appears to be related to *R. labialis* Boulenger, although that species is said to be allied to *R. chalconota*. From *Rana labialis* it differs in having the first and second fingers equal, and the disks of the toes practically of the same diameter as those of the fingers; the lateral glandular folds are distinct to the end of the body. Unfortunately, I have no specimens of *R. labialis* for comparison.

The species is named for Father F. Sanchez, S. J., of Ateneo de Manila.

*Rana sanguinea* Boettger. Plate 5, fig. 2.

*Rana sanguinea* BOETTGER, Zool. Anz. 16 (1893) 364.

*Rana varians* BOULENGER, Ann. & Mag. Nat. Hist. 14 (1894) 86;  
Proc. Zool. Soc. London (1897) 231; BARBOUR, Mem. Mus. Comp.  
Zool. Harvard Coll. 44 (1912) pl. 5, fig. 12.

*Description of species*.—(From No. F60, Bureau of Science collection; collected in the extreme northern end of Palawan, P. I., May 10, 1918, by E. H. Taylor.) Vomerine teeth in two oblique transverse series, somewhat separated from choanæ and extending behind the posterior edge, separated from each other by a distance less than half the length of a single series; tongue rather pear-shaped, with two rounded horns behind; head rather depressed, slightly concave on forehead, nearly one-third longer than broad; canthus rostralis angular, distinct, the snout rather obtusely pointed; loreal region nearly vertical, only slightly concave; distance from nostril to tip of snout contained slightly more than twice in distance from nostril to eye; interorbital region slightly concave, about as wide as an eyelid; tympanum large, very distinct, separated from eye by a distance less than

one-half the diameter of tympanum; latter little more than three-fourths the diameter of eye; a slight, distinct dorsolateral skin fold from eye along sides to end of body; another very dim fold from eye to insertion of forearm above tympanum continuous anteriorly with the lateral folds; fingers unwebbed, with small, longitudinally oval disks, about the size of, or a little larger than, the subarticular tubercles; three large, distinct tubercles on palm; first finger much longer than second, which is shorter than fourth; toes about four-fifths webbed, webs not reaching base of disks, save on outer side of first three toes; on fourth toe web reaches a little above last subarticular tubercle; toes with well-developed disks, larger than disks on fingers; well-developed inner and outer metatarsal tubercles, inner oval, outer rounded; no skin flap on outer toe; no fold on tarsus or heel; tibiotarsal articulation reaches beyond tip of snout by a distance equal to that from eye to end of snout; skin almost smooth above, with no granulations apparent; skin on chin, sides, and belly smooth; a granular area on ventral aspect of thighs and on eyelids; skin on upper part of tibia granular.

*Color in life.*—Above pinkish brown, with dim darker reticulations; loreal region from point of snout to eye dark blackish brown; a large, dark black-brown spot behind eye, limited by the dim skin fold from eye to arm, entirely covering tympanum but not reaching mouth; a small longitudinal spot on anterior base of arm; posterior side of arm with dark spots and markings; a few scattered small spots on sides; transverse bars on anterior part of foreleg; hind leg with dusky transverse bars, anterior aspect of limb spotted and mottled with dark brown; posterior aspect of thighs yellow, reticulated with brownish; a brown stripe on anterior side of tibia; below creamy, yellow on posterior part of belly; chin rather dusky, lower jaw darker, with cream spots; breast with two rather large distinct spots; entire interdigital membrane dark; heel and under part of foot dark.

*Measurements of Rana sanguinea Boettger.*

	Female. mm.	Male. mm.
Length, snout to vent	62	40
Length of head	24	16
Width of head	18	12
Diameter of eye	6.5	5
Diameter of tympanum	5.4	3.8
Length of snout	10.5	7.5
Height of head, in front of eye	7	4
Foreleg	38	27
Hind leg	119	82
Tibia	39	28

*Variation.*—Two small specimens taken in the same locality agree very well with the one described. One of them is reddish brown above, the other grayish brown; the latter lacks the two spots on the breast, and the lip above is rather whitish. Two specimens taken at Concepcion, Busuanga, agree with the latter specimen in having a stripe on the upper part of the lores and the lip rather lighter. In these specimens the fold from the eye to the arm is very dim or wanting.

*Remarks.*—Boettger described his *Rana sanguinea* in 1893, and Boulenger his *R. varians* in 1894. Both species are recorded as being related to *R. temporalis* Günther. A comparison of descriptions reveals no essential differences. I am convinced that the two species are identical, and that the type of *R. sanguinea* Boettger is an immature specimen of *R. varians* Boulenger. I have no specimens of *R. sanguinea* from the type locality, which is Culion, but have a specimen from a nearby locality, Busuanga, at a point on the island nearest Culion. Boettger<sup>14</sup> describes a *R. moluccana* from Halmaheira and Ternate, while in a later work<sup>15</sup> he regarded this species as identical with *R. varians* Boulenger. Barbour<sup>16</sup> fails to agree with the later conclusion, but retains the species as distinct from *R. varians* Boulenger. Boettger evidently recognizes Boulenger's species as distinct and makes no mention of *R. moluccana* as being related to *R. sanguinea*.

Let us note the differences between the recorded description of the type and the description of the other two species. In *Rana varians* the tympanum is as large or nearly as large as the eye; in *R. sanguinea* it is more than three-fourths of the eye. In *R. varians* the interorbital distance is as broad as the upper eyelid or a little narrower; in *R. sanguinea* it is broader than a single eyelid. *Rana varians* has the toes nearly entirely webbed, the last two phalanges of the fourth toe free; *R. sanguinea* has the toes three-fourths webbed, the last two phalanges of the fourth toe free. In *R. varians* the tibiotarsal articulation reaches the snout or beyond; in *R. sanguinea* it is one and one-half times as long. In *R. varians* the tibia is as long as the foreleg or a little shorter; in *R. sanguinea* it is slightly longer. None of the characteristics are contradictory; the only significant ones are the difference in the length of the hind leg and

<sup>14</sup> Zool. Anz. 18 (1895) 132.

<sup>15</sup> Abh. Senck. Nat. Ges. 25 (1900) 366.

<sup>16</sup> Mem. Mus. Comp. Zool. Harvard Coll. (1912).



in the reach of the tibiotarsal articulation. Boettger mentions a small glandular fold below the tympanum behind the mouth in *Rana sanguinea* which Boulenger does not mention in his species.

Undoubtedly, the species which I have described is *Rana sanguinea*, but certain variations occur which should be considered. In the largest specimen the small fold behind the mouth is not evident; in nearly all the specimens there appears to be a slight supratemporal fold; the spots on the breasts are wanting in two specimens. There is some variation in the reach of the tibiotarsal articulation. In the younger specimens the dorsolateral folds are dim or wanting.<sup>17</sup>

*Rana everetti* Boulenger. Plate 6, figs. 1, 1a, and 1b.

*Rana everetti* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 72, pl. 6; Proc. Zool. Soc. London (1897) 232.

*Description of species.*—(From type description, Boulenger.) "Vomerine teeth in two small oblique series, commencing on a level with the hinder edge of the choanæ. Head depressed; snout rounded, with distinct canthus rostralis and concave loreal region; interorbital space as broad as the upper eyelid; tympanum three-fourths the width of the eye. Fingers slender, first not extending as far as second; toes moderate, entirely

<sup>17</sup>I append the original description of *R. varians* Boulenger, Ann. & Mag. Nat. Hist. VI 14 (1894) 86.

"4. *Rana varians* sp. n.

"Closely allied to *R. temporalis*, Gthr. Vomerine teeth in two oblique series extending beyond the level of the hinder edge of the choanæ. Head depressed, longer than broad; snout obtusely or acutely pointed, prominent, longer than the diameter of the orbit; canthus rostralis angular; loreal region nearly vertical, strongly concave; nostril nearer the tip of the snout than the eye; interorbital space as broad as the upper eyelid or a little narrower; tympanum very distinct, as large as the eye or a little smaller. Fingers moderate, first extending beyond second; toes nearly entirely webbed; tips of fingers and toes dilated into well-developed disks; subarticular tubercles well developed; inner metatarsal tubercle oval, blunt; a small round outer metatarsal tubercle; no tarsal fold. Tibio-tarsal articulation reaching beyond the tip of the snout; tibia as long as the fore limb. Skin finely granulate, with or without scattered small warts; a narrow glandular dorso-lateral fold. Brown, pink, or dark grey above; a black streak below the canthus rostralis and a black temporal blotch; limbs with dark cross bands; hinder side of thighs marbled with brown; some specimens with a pale line along the vertebral line and another along the upper surface of the tibia. Male with internal vocal sacs and without humeral gland.

"From snout to vent, ♂ 43 millim., ♀ 70."

webbed; tips of fingers and toes dilated into disks, those of the former large, measuring about two-thirds the width of the tympanum, those of the latter smaller; subarticular tubercles well developed; a small oval inner, and an indistinct outer metatarsal tubercle. The hind limb being carried forwards along body, reaches the tip of the snout. Skin smooth; a rather indistinct glandular fold above the tympanum; angles of the mouth glandular."

*Color*.—"Light greyish brown above, with round dark spots; limbs indistinctly cross-barred; under surface of hind limbs speckled with greyish brown."

*Remarks*.—Boulenger has given no measurements for this species, but it is presumed that his superb figure reproduced here is life size. It measures 88 millimeters from snout to vent.

The type, a female specimen, is from Zamboanga, and was collected by Everett. The species has since been found by the same collector in Borneo and Celebes. *Rana everetti* may be distinguished from *R. varians* (= *R. sanguinea* Boettger) by the following characters: The first finger is shorter than the second; the finger disks are larger, equal to from one-half to two-thirds the tympanum; the tibiotarsal articulation reaches tip of snout or a little beyond; the males have internal vocal sacs and no humeral gland; a white streak usually borders the upper lip. *Rana everetti* is said to lay its eggs in a frothy mass out of the water.

*Description of tadpoles*.—(From Boulenger.)<sup>18</sup> "Length of body once and a half to once and two-thirds its width, about half as long as the tail. Nostrils nearly equally distant from the eyes and the tip of the snout. Eyes on the upper surface, equally distant from the tip of the snout and the spiraculum, the distance between them a little greater than the distance between the nostrils. Spiraculum on the left side, directed upwards and backwards, nearer the posterior extremity of the body than the end of the snout. Anal opening on the right side close to the lower edge of the caudal crest. Tail about thrice and a half as long as deep, acutely pointed; crests lower than the muscular portion, the dorsal not extending on the body. Mouth as broad as the interocular space; series of labial teeth  $\frac{4}{3}$ , the outer upper and the three lower continuous, the others restricted to the sides; lower lip bordered by a double series of papillæ; beak broadly edged with black. Dark brown or blackish above, greyish below; upper caudal crest dark brown, lower greyish.

<sup>18</sup> Proc. Zool. Soc. London (1897) 232.

"Total length 45 millim.; body 14; tail 31; depth of tail 8.

"This tadpole is essentially that of a typical *Rana*."

*Rana suluensis* sp. nov.

*Type*.—No. 1638, Bureau of Science collection; collected near the southern end of Tawitawi Island, P. I., October, 1918, by E. H. Taylor.

*Description of type*.—(Female.) Vomerine teeth in two short, obliquely placed series between choanæ, separated from the latter by a distance half their length, and from each other by a distance nearly equal to their length; choanæ large, distinct, distance between them greater than distance from eye to nostril; distance between Eustachian tubes equals their distance from nostril; head rather flat, longer than broad, very slightly depressed on middle part of snout; canthus rostralis angular; loreal region nearly vertical, somewhat concave; snout rounded when viewed from above, rather pointed when viewed laterally, projecting; nostril much nearer end of snout than eye; distance between nostrils equals their distance from eye, as well as the interorbital distance and width of upper eyelid; diameter of eye reaches beyond nostril; diameter of tympanum from two-thirds to three-fourths that of eye; tympanum very distinct; skin above smooth or minutely granular; no dorsolateral glandular folds; no supratympanic folds; no fold or a very indistinct one above insertion of forearm; skin on sides with occasional, rather large tubercles; limbs smooth above and below; belly, chin, and throat entirely smooth; anal region strongly granular; limbs slender; first finger very slightly longer than second, both a little shorter than fourth; fingers with small disks, rather pointed in front; subarticular tubercles distinct; three distinct carpal tubercles, the largest at base of first finger; toes slender, long, the disks larger than the finger disks, tips somewhat pointed; toes scarcely more than half webbed; the membrane reaches second subarticular tubercle on fourth toe; fifth longer than third, reaching midway between first and second subarticular tubercles; a small inner metatarsal tubercle equal to about one-fourth the length of first toe, and a distinct outer metatarsal tubercle; subarticular tubercles of toes well developed; a very slight fold from tip of fifth toe to tibia; males with well-developed internal vocal sacs; tibiotarsal articulation reaches nostril.

*Color in life*.—Above grayish brown to reddish brown, variegated dimly with purplish, darker brown, and with numerous



small, rounded blackish spots with grayish centers; tip of snout whitish, a dorsolateral silver-gray line from tip of snout to end of body; sides of head and temporal region dark blackish brown, somewhat lighter on sides of body; sides with darker grayish-centered spots; a white line from tip of snout to above arm; arm with dark purple stripe on posterior side, and a dark stripe on underside near insertion; hind limb lighter brown than back, strongly barred with blackish to purplish brown; underside of foot purplish, the outer tubercle white; belly silvery white; chin slightly dusky; hind legs dusky white, below yellowish white; posterior part of thigh dark, marbled and reticulated with yellowish.

*Measurements of Rana suluensis sp. nov.*

	mm.
Length, snout to vent	47.5
Length of head	19.5
Width of head	13.5
Diameter of eye	6.1
Diameter of tympanum	4.8
Tympanum, from eye	1.25
Eye to nostril	51
Length of snout	7.3
Distance between nostrils	4.6
Foreleg	30
Longest finger	13.5
Hind leg	81
Femur	23.2
Tibia	26
Longest toe	24
Largest toe disk	1.1

*Variation.*—The chief variation noted is the presence of a narrow, glandular, dorsolateral fold on several younger specimens, which is dim or wanting on older specimens.

One specimen from the same island was uniformly light brown above, with a distinct dorsolateral fold, the back strongly granular, the granules of different sizes; upper part of legs strongly granular and with longitudinal folds; younger specimens are darker on throat and belly, usually lighter on back, the dark spots not round.

*Remarks.*—This species is related to *Rana sanchezi*, from Palawan, and *R. labialis*, from Borneo, Java, and Malay Peninsula. It differs from these in the lesser extent of webbing between toes, in color and markings, and in the smaller finger disks, which are smaller than those on toes. The species was taken only on

Tawitawi and a small island at the extreme southern end, only a few meters from the seacoast, at some distance from fresh water. They were found hopping about the base of a large *balete* tree, on the sides, and about roots. They would take refuge under leaves and root masses. They appeared common in these two localities, but were not observed elsewhere. Fourteen specimens were preserved.

*Rana philippinensis* sp. nov.

*Type*.—No. 662, E. H. Taylor collection; collected in Mindanao, P. I., August 12, 1913, by E. H. Taylor.

*Description of type*.—Vomerine teeth in two oblique rounded groups, separated from choanæ and from each other by an equal distance; tongue large, without papillæ; distance between Eustachian tubes much less than their distance from choanæ; distance between choanæ equal to distance between nostrils; head obtusely pointed in upper and lateral profile, projecting somewhat; loreal region nearly vertical, somewhat concave; interorbital region one and one-fourth times upper eyelid; eye large, diameter of orbit equal to the distance to tip of snout; nostril very much nearer tip of snout than eye; tympanum distinct, a little more than three-fifths eye, separated from eye by a distance equal to less than one-third its diameter; skin on entire body smooth; no granules on posterior part of thigh in anal region; no fold above tympanum; no dorsolateral fold; fingers long, large, with pointed disks, larger than subarticular tubercles, which are distinct and well developed; first finger opposed to rest of hand, longer than second, only minutely shorter than fourth, and reaching last joint on third; disks with a small groove around edge; carpal tubercles elongate, comparatively small; no gland on upper arm; toes with pointed disks, larger than those on fingers, and larger than subarticular tubercles on foot; toes nearly two-thirds webbed, webs not reaching disks; an elongate inner metatarsal tubercle and a small outer tubercle present; tibiotarsal articulation reaching beyond eye.

*Color in life*.—Above on back and head yellow to olive brown, with indistinct darker mottling; a broad distinct dark brown dorsolateral stripe from eye to end of body; sides olive yellow, with darker mottling; eyelids dark; tympanum golden yellowish, tympanic region dark brown; limbs yellowish olive brown, with irregular spots and marblings not forming bars; throat dusky brown, belly lighter.

*Measurements of Rana philippinensis sp. nov.*

	mm.
Length, snout to vent	50
Length of head	20.5
Width of head	16
Diameter of eye	8
Length of snout	8.1
Tympanum	4.9
Interorbital area	6.5
Foreleg	35
Longest finger	14.5
Hind leg	86
Femur	22
Tibia	28
Longest toe, with metatarsal	26
Diameter of toe disk	1.4

*Remarks.*—Only a single specimen, an adult female with eggs, has been collected. The character of the opposed first finger seems to differentiate it clearly from other Philippine species of *Rana*. The markings and the color are characteristic.

*Rana dubita sp. nov.*

*Type.*—No. 1460, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, June, 1913, by E. H. Taylor.

*Description of type.*—Vomerine teeth in two slight series between the choanæ, their hinder edge on a level with the choanæ, separated rather widely by a distance of at least half their length; snout rather obtuse, not sloping strongly in front; canthus rostralis evident, rather angular; loreal region nearly vertical, strongly concave; head about one and one-third times as long as broad; snout moderately long; diameter of eye equal to distance from eye to a little beyond nostril; nostril nearer tip of snout than eye; distance of nostril to point of snout contained in distance from nostril to eye a little more than twice; tympanum round, large, its diameter from two-thirds to three-fourths eye; separated from eye by a distance less than half its diameter; interorbital distance much wider than one upper eyelid; skin smooth on back, sides, and belly; no granulation on limbs; probably a very slight lateral fold; no supratemporal fold apparent; fingers slender with large disks; first finger with very small disk, not wider than digit, less than half the width of second finger disk; second finger much shorter than fourth; latter reaching to near base of disk of third finger; largest disks one-half to two-thirds tympanum, disks with a distinct groove around edges; toes broadly webbed, the membrane reaching disk on outer side of first, second, and third toes, and on inner side of fifth; it reaches



last subarticular tubercle on fourth toe; disks not as large as those on fingers, those on second and third toes largest; tibio-tarsal articulation reaching about halfway between eye and nostril.

*Color in life.*—Dark, rather blackish brown above, darker on head; a white line along upper lip, widening below tympanum and continuing back above front limb; arms lighter brown, barred with darker; subarticular tubercles of fingers whitish, a white spot on fingers above at base of disk; hind legs brown, spotted or mottled indistinctly with darker brown; a few yellowish white markings on posterior aspect of thigh and tibia; below dusky yellowish white with darker spots and marbling; underside of thighs yellowish with a few dark spots; interdigital membrane of toes dusky.

*Measurements of Rana dubita sp. nov.*

	mm.
Total length, snout to vent	34.5
Length of head	15
Width of head	11.2
Length of snout	6
Diameter of orbit	4.2
Diameter of tympanum	3.9
Length of longest finger	10
Length of longest toe	14.5
Tibia	19.5
Foreleg	22
Hind leg	56

*Remarks.*—A single specimen was collected at Bunawan, Agusan. It was found in deep forest about 100 meters from water.

*Rana melanomenta sp. nov.*

*Type.*—No. 1661, Bureau of Science collection; collected at Papahag, Sulu, P. I., October 5, 1917, by E. H. Taylor.

*Description of type.*—Vomerine teeth in two slender oblique series lying between, but extending a little behind, posterior part of choanæ; separated from choanæ by a distance about as great as a single series, from each other by a distance little more than half the length of one series; distance between Eustachian tubes greater than their distance from choanæ; distance between choanæ equals distance between nostrils; tongue without papilla; males with vocal sacs, the openings large; canthus rostralis distinct, slightly rounded; nostrils nearer end of snout than eye; diameter of eye less than snout, barely reaching beyond nostril; tympanum distinct, about three-fifths eye, separated from eye by a distance equal to one-half its diameter; interorbital distance

equal to, or slightly less than, the width of an upper eyelid; loreal region sloping, concave; snout rounded in upper and lateral profile, projecting somewhat; skin on back, sides, and belly smooth; granular on lower and posterior aspect of thighs; skin on chin over vocal sacs somewhat distended and wrinkled; no fold above tympanum; no dorsolateral fold; a distinct glandular tubercle above insertion of arm; no gland on upper part of arm; fingers with small digital disks no longer than subarticular tubercles, which are distinct; first finger longer than second and but slightly shorter than fourth; first finger with nuptial excrescences; three carpal tubercles, large, well defined; each disk with simple groove around edge; toes from one-half to two-thirds webbed, the webs failing to reach disks except as a very narrow margin; disks on toes about as large as those on fingers, and apparently larger than subarticular tubercles of toes; an oval inner, and a rounded outer, metatarsal tubercle.

*Color in life*.—Above lavender-brown, with a wash of gray; a few very small black spots scattered over upper surface; laterally lavender-brown, with darker markings above arm; sides of head and tympanum black; throat black, belly dusky with white marblings; limbs closely barred with blackish; posterior aspect of thigh with small white dots; a white spot at final joint of digits.

*Measurements of Rana melanomenta sp. nov.*

	mm.
Total length, snout to vent	35
Length of head	19
Width of head	13
Diameter of eye	4.6
Length of snout	6.3
Foreleg	26
Longest finger	10
Hind leg	66
Tibia	19
Femur	18
Longest toe, including metatarsal	1.8

*Variation*.—Four specimens were taken, all agreeing with the type in essential characters; one specimen has the throat black, with numerous white spots. The third and fifth toes of all except the type are practically the same length; in the type, however, the third toe of the right foot is much longer than the fifth.

*Remarks*.—These specimens were all obtained near small pools of stagnant water in the forest on Papahag, near Tawitawi. The species was observed on other islands, but no specimen was taken. In the character of the digits it appears to be closely

related to the group to which *Rana similis*, *R. grandocula*, and *R. glandulosa* belong. It differs in having smaller eyes and a shorter snout and in the absence of a papilla on the tongue and of the arm gland.

*Rana moellendorffi* Boettger. Plate 1, fig. 4.

*Rana moellendorffi* BOETTGER, Zool. Anz. 16 (1893) 363.

*Description of species.*—(From No. 1482, Bureau of Science collection; collected in northern Palawan, P. I., May 10, 1918, by E. H. Taylor.) Vomerine teeth in two small, rounded, oblique series, very much nearer to each other than to the choanæ, extending behind posterior level of choanæ; tongue rather oval, small, with the two "horns" at the posterior corners, which are rather widely separated at their bases; no papilla; males with vocal sacs, the internal openings small; head somewhat longer than broad, not concave; snout obtusely pointed; eyes not especially prominent; interorbital area nearly one and a half times upper eyelid; diameter of eye only slightly less than length of snout; canthus rostralis rather rounded; lores nearly vertical, with a distinct longitudinal groove behind nostril; distance from nostril to end of snout less than its distance from eye; tympanum very distinct, little more than half diameter of eye, separated from eye by a distance less than one-third its diameter; skin smooth or finely shagreened above, indistinctly granulate on posterior part of eyelids and on sides; skin smooth below save on ventral surface of thigh; no dorsolateral fold; no fold or only a very indistinct one from eye above tympanum; a distinct gland on upper part of arm; fingers slender, with very slight longitudinal oval pads, scarcely wider than fingers; first finger slightly longer than second, fourth longer than first or second, reaching base of disk of third; toes three-fourths webbed, the webs nowhere reaching base of toe disks, which are as large as finger disks; subarticular tubercles well developed; inner metatarsal tubercle elongate, oval, outer smaller, rounded; hind leg brought forward, tibiotarsal articulation reaches somewhat beyond eye.

*Color in life.*—Above yellowish to bronze green; the entire back, head, and sides covered with large, usually elongate black spots, which frequently join each other, forming islandlike designs; a black loreal streak, below which is a yellow-green line; below this a short dark stripe on edge of lip; tympanum dark brown; dark spots on breast at insertion of arms; arm spotted with black above and a broken dark line on posterior side;



limbs strongly barred with black; posterior part of hind limb black, with a few yellowish white spots on femur; groin similar; below dirty white, with lighter yellowish spots; membrane between toes dark.

*Measurements of Rana moellendorffi Boettger.*

	mm.
Total length, snout to vent	40
Length of head	15
Width of head	13.5
Diameter of eye	5.2
Diameter of tympanum	4
Length of snout	6.1
Tibia	20
Femur	19
Foreleg	27
Hind leg	61

*Variation.*—Three other specimens, all of which are males, taken in the same locality, agree remarkably well with the described specimen, especially in color; two have the entire head outlined above with greenish yellow and the lower labials spotted with yellow; some of the specimens show the presence of a slight glandular area below, and slightly behind, tympanum.

These agree with the type description in essential details, save that the tibiotarsal articulation of the type reaches the point of the snout, while in the specimens at hand it reaches only a short distance beyond the eye; in these also the head is distinctly longer than wide, while in the type the head is as long as wide. The fact that the types are considerably larger, and probably females, may account for the discrepancy. Either the gland on the upper arm was overlooked by Boettger, or it is absent in the type.

*Remarks.*—The specimens were collected on the extreme northern end of Palawan Island. They were found perched on vines growing on trees at the edge of small streams. No other specimen was seen. The type locality is Culion, which is near Palawan.

*Rana similis* (Günther). Plate 4, fig. 5.

*Polypedates similis* GÜNTHER, Proc. Zool. Soc. London (1873) 171.

*Rana similis* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 72.

*Description of species.*—(From No. F326, E. H. Taylor collection; collected on Mount Maquiling, near Los Baños, Luzon, P. I., April 5, 1916, by E. H. Taylor.) Vomerine teeth in two

small, distinct, oblique groups lying between, and for the most part posterior to, the hinder level of choanæ; latter moderately large, distant from vomerine teeth by more than length of a single group; tongue rather small, with a moderate notch behind; a distinct, rounded, low papilla on tongue; males with vocal sacs, the openings small, rounding; snout short, equal, or nearly equal, in length to diameter of eye, rather rounded anteriorly; head longer than wide; canthus rostralis angular, loreal region concave, nearly vertical; tympanum large, distinct, about two-thirds eye, separated from eye by a distance about half its diameter; distance of nostrils from each other equals their distance from eye; interorbital distance equal to upper eyelid; nostril more than twice as far from eye as from tip of snout; skin above smooth on head and body, minutely pitted; sides smooth; chin and belly smooth; ventral and posterior parts of thighs granular; no dorsolateral skin fold; no supratympanic fold; a small glandular fold at corner of mouth and two smaller ones above insertion of arms; fingers slender, with small, distinct disks, those of third and fourth fingers of equal size, larger than those on first and second; first finger extending slightly farther than second, both shorter than fourth; an enlarged nuptial excrescence on inner side of first finger; an enlarged gland on upper arm; subarticular tubercles distinct, well developed; carpal tubercles large, distinct; toes about two-thirds webbed, membranes not reaching disks except as very narrow fringe on outer side of digits; toes with small disks slightly pointed, nearly as large as largest finger disks; an elongate inner metatarsal tubercle, and a small round outer tubercle; no skin fold on fifth toe; no tarsal fold; hind leg brought forward, tibiotarsal articulation reaches a little beyond eye; when viewed from above, eyes project beyond outline of jaws.

*Color in life.*—Above olive slate, slightly mottled with lighter olive on head; an olive yellow line from tip of snout along canthus rostralis, across edge of upper eyelid, to end of body along the dorsolateral edge; from tip of snout to eye a purplish slate loreal area; behind eye on sides dark purplish slate; tympanum brown; a narrow labial line, beginning in front of eye, continues to angle of mouth, ending in a white spot on the dim granular fold; lower side mottled with greenish yellow; throat dusky; belly dirty white; limbs olive above, with numerous, broad, slate bars, five or six on the tibia, and continuing on the foot; heel and underside of foot dark; underside of hind legs dusky.

*Measurements of Rana similis (Günther). Nos. F326 and F325.*

	mm.	mm.
Length, snout to vent	46	46
Length of head	17	16
Length of snout	6.5	6.6
Width of head	14	14.2
Diameter of eye	6.5	6.2
Diameter of tympanum	4.6	4.2
Depth of head, in front of eye	6	6
Foreleg	31.5	28.2
Longest finger	11	11.6
Hind leg	77	69.5
Femur	19.5	18.5
Tibia	24	19.5
Foot	33	31
Longest toe	21.5	19
Toe disk	1.2	1.5

*Variation.*—Eight specimens in my collection from Los Baños exhibit but very little variation in color and markings. All appear to be males; at least all have the internal openings to the vocal sacs. Comparison of the measurements in the preceding table with the following measurements of several specimens will show that there is a slight variation in the length of the hind leg.

Body length.	Hind leg.
mm.	mm.
43.5	70
46	77.5
46.5	69.5
41	67.5
44.5	69
44	69
45.2	71.5

In these specimens the tibiotarsal articulation reaches to the eye and, possibly, slightly beyond.

*Remarks.*—The smooth skin, the shorter legs, the presence of a swelling, or papilla, on the anterior part of the tongue, and the gland on the upper arm seem to distinguish this species from *Rana signata* Günther. *Rana moellendorffi* Boettger, from Palawan and the Calamianes, is very closely related also; the markings, however, of *R. moellendorffi* are strikingly different, the interorbital distance is wider, usually one and a half times the eyelid, and the papilla is absent from the tongue. Other differences are in evidence on a comparison of the specimens.

Specimens in the collections are from Bataan and Laguna Provinces, Luzon; the type is from "Laguna de Bay," Luzon, and



was collected by A. B. Meyer. Boulenger is of the opinion that *Rana similis* and *R. signata* are the same species.

*Rana grandocula* sp. nov. Plate 7, figs. 2 and 2a.

*Type*.—No. F334, E. H. Taylor collection; collected near Bunawan, Agusan, Mindanao, P. I., August, 1912, by E. H. Taylor.

*Description of type*.—Vomerine teeth in two small, slightly diagonal, rounded series between choanæ, posteriorly separated from choanæ by a distance much greater than the length of a single series, and from each other by a distance less than half of a single series; distance between openings of Eustachian tubes less than their distance from choanæ; distance between choanæ equals distance between nostrils; head longer than wide, snout protruding slightly; eyes very large and protruding; diameter about one-fourth or one-fifth longer than snout; nostril nearer tip of snout than eye; tympanum quite distinct, its diameter about half of eye, separated from eye by a distance equal to one-third of its diameter; canthus rostralis distinct, roundly angular, the loreal region nearly vertical, the lores concave; width of upper eyelid little more than one and one-third times interorbital distance; skin of body above and below entirely smooth; a few granules on posterior aspect of thigh and about anal region; no dorsolateral fold; no fold above tympanum; digits slender, tips of fingers and toes dilated into small disks with grooves around their edges; first finger extending as far as, or very slightly farther than, second, both but slightly shorter than fourth, which just fails to reach base of disk on third; sub-articular tubercles well developed, as are the carpal tubercles; first finger with nuptial swellings; toes about two-thirds webbed, the membrane failing to reach disks but approaching nearest on second toe; third and fifth toes of nearly equal length; sub-articular tubercles strong; an elongate, inner metatarsal tubercle more than one-third the length of first toe; a rounded, fairly prominent, outer metatarsal tubercle; disks rather pointed at tips; tibiotarsal articulation reaches anterior edge of eye or slightly farther; a distinct oval gland on inner side of upper arm; males with internal vocal sacs, the openings rather far back on either side of tongue.

*Color in life*.—Above olive to chestnut brown, with numerous indistinct darker flecks and spots; sides slightly darker and rather thickly spotted; limbs with spots or bars; dusky brown on throat and chin, lighter on belly; underside of feet and hands rather purplish, the tubercles lighter; a distinct light spot above last joint of digits.

*Measurements of Rana grandocula* sp. nov. Nos. F334 and F337.

	mm.	mm.
Length, snout to vent	40	44
Length of snout	6.2	6.1
Diameter of eye	7.3	7.1
Diameter of tympanum	3.8	4.2
Interorbital distance	3.4	3.6
Upper eyelid	5.1	5
Length of head	16.5	17
Width of head	13	14.5
Foreleg	25	27
Longest finger, from wrist	11	11
Hind leg	65	68.2
Femur	18.2	20
Tibia	19.8	21.2
Foot	27.5	29
Longest toe	17	19.5
Finger disks	1.2	1.2
Toe disks	1.1	1.3

*Variation.*—Several specimens in the collection show but little variation. The ground color varies from darker to lighter than the type. Some of the specimens have a distinct white line on the upper lip. The gland on the arm seems to be present in both sexes.

*Remarks.*—There are several specimens of this species in my collection, all from Agusan River Valley, near Bunawan. It appears to be closely related to *Rana similis* (Günther) but differs from it strikingly in the much larger and more prominent eye, the shorter snout, the smaller tympanum, the absence of a fold at angle of mouth, and the very different markings and coloration. Specimens were taken along Bunawan River in large pools in worn rocks; numerous in this locality.

*Rana glandulosa* Boulenger. Plate 5, figs. 1, 1a, and 1b.

*Rana glandulosa* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 73, pl. 7; Ann. & Mag. Nat. Hist. VI 14 (1894) 87; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 448; FLOWER, Proc. Zool. Soc. London (1896) 905; (1899) 897; LAIDLAW, Proc. Zool. Soc. London (1900) 887.

*Description of species.*—(From Boulenger.) “Vomerine teeth in two short oblique series, between the choanæ. Head rather large; snout rounded, as long as the orbit, with obtuse canthus rostralis and concave loreal region; nostril nearer snout than eye; interorbital space nearly same as upper eyelid; tympanum distinct three-fifths to three-fourths the diameter of the eye; fingers rather elongate, first extending much beyond the second; toes moderate one-half to two-thirds webbed; tips of fingers

and toes merely swollen or dilated in small discs; subarticular tubercles prominent; a small oval inner metatarsal tubercle and a small round one at the base of the fourth toe; tibiotarsal articulation reaches the eye or between the eye and the tip of the snout; back more or less distinctly granulate, with large flat granules at least on the sides."

*Color*.—"Olive or reddish brown, spotted and speckled with blackish; lips dark with large whitish spots or bars; limbs with dark crossbars; lower parts whitish or buff, uniform or spotted with brown. Eye fiery red. Male with vocal sacs on each side forming folds and a large oval gland on the inner surface of the arm. Snout to vent, 95 mm. Found in caves in total darkness."

*Remarks*.—The types were obtained in Sarawak by A. Everett, who later discovered the species in Palawan; I failed to find it in Palawan. Boulenger reports it from Malay Peninsula.

#### Genus STAUROIS Cope

*Ixalus* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 15, part.

*Staurois* COPE, Nat. Hist. Rev. (1865) 117.

*Rana* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 71, part.

*Micrixalus* BOULENGER, Proc. Zool. Soc. London (1888) 205; Fauna Brit. India, Rept. (1890) 464.

No vomerine teeth; tympanum distinct; fingers free, with disks; toes webbed; otherwise agrees very well with *Rana*.<sup>19</sup>

One species is found in Palawan, Minadanao, and nearby islands. Very probably it does not enter Luzon, the western Visayan Islands, or Mindoro.

<sup>19</sup> Boulenger, Ann. & Mag. Nat. Hist. IX 1 (1918) 374, has redefined this genus, listing five species: *Staurois larutensis* Boulenger, Borneo and Malay Peninsula; *S. guttatus* Günther, Borneo; *S. natator* Günther, Philippines; *S. nubilus* Mocquard, Palawan; and *S. tuberilinguis* Boulenger, Borneo. He mentions the following generic characters:

Tympanum small; with or without vomerine teeth; disks on fingers large, broader than long, larger than those of toes, with a half disk within the disk on the lower surface; toes fully webbed, the webs involving base of disks; outer metatarsal separated to base.

The recognition of Mocquard's species *Ixalus nubilus* = *Staurois nubilus* by Boulenger in this paper presents an opinion in which I do not concur. My own collection has more than one hundred specimens of *S. natator* from Mindanao, and I have recently been able to examine specimens of what is probably Mocquard's *Ixalus nubilus* from various parts of Palawan and Busuanga. Occasional specimens from both lots show a papilla on the tongue; there appears to be no difference in average measurements; the granules on the Palawan specimens appear a little coarser than on most of the Mindanao specimens.



*Staurois natator* (Günther). Plate 4, figs. 2 and 2a.

*Ixalus natator* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 15, pl. 4, fig. C; Proc. Zool. Soc. London (1879) 79.

*Staurois natator* COPE, Nat. Hist. Rev. (1865) 117.

*Rana natatrix* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 71; BOETTGER, Ber. Senck. Nat. Ges. (1886) 121.

*Staurois natator* BOULENGER, Ann. & Mag. Nat. Hist. VI 14 (1894) 87.

*Ixalus nubilus* MOCQUARD, Nouv. Arch. Mus. 2<sup>e</sup> (1890) 153, pl. 11, fig. 3.

*Description of species.*—(From No. 1601, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., August 12, 1912, by E. H. Taylor.) Vomerine teeth wanting; tongue elongate, oval, deeply notched behind; choanæ large; canthus rostralis angular, curving in between eye and nostril; loreal region vertical for some distance, then sloping out, with the lip nearly vertical; snout narrower behind nostrils than directly in front; tip of snout vertical, rounding in outline; eye very large, equal or nearly equal to length of snout; tympanum small, circular, its diameter from one-third to two-fifths eye; separated from eye by a distance less than half its diameter; interorbital region narrow, a little less than width of upper eyelid; distance of nostrils from each other less than their distance from eye; nostril half as far from eye as from end of snout; skin strongly granular above on loreal region, above eyelids, and back of body; upper surface of limbs smooth; chin and breast smooth; belly and sides with larger granules; anal region and part of underside of thighs granular; no distinct supratemporal fold; no tarsal fold; fingers large, with wide, roughly triangular disks, diameter of disk larger than tympanum; first finger shorter than second, second shorter than fourth, fourth not reaching base of disk of third; fingers unwebbed; toes completely webbed, the membranes reaching base of disks; disks on toes more rounding and a little smaller than disks on third and fourth fingers; disks with distinct grooves on edges and with a transverse depression above; fifth toe extending slightly farther than third, fourth longest; a small inner metatarsal tubercle and a still smaller outer tubercle; subarticular tubercles small, not very clearly defined; the tibiotarsal articulation reaches much beyond snout. Male with internal vocal sacs.

*Color in life.*—Above olive to bronzy green, mottled with darker; legs lighter, barred with the ground color of back; lips, chin, belly, and sides light blue-green, which color penetrates body; tongue, inside of mouth, body cavity, and intestines light blue-green; interdigital membrane of toes dusky.

*Measurements of Staurois natator (Günther).*

	mm.
Length, snout to vent	58
Length of head	18
Width of head	14
Length of snout	7.6
Diameter of eye	7.2
Diameter of tympanum	2.2
Foreleg	33
Longest finger	14.4
Hind leg	85
Femur	25
Tibia	28.5
Longest toe	21.5

*Variation.*—The variations in this species are chiefly in coloration, that given being most nearly typical. Sometimes the color of the back is bronze with yellowish spots or reticulations; sometimes the blue-green skin on sides and belly has a slight wash of yellow; certain specimens are dark greenish brown with cream yellow spots on sides and back; a small specimen in the Bureau of Science collection preserved in alcohol (No. 1669) has all the legs barred with brown and cream, a darker line from tip of snout through eye above tympanum, and the back brown, with cream reticulations.

*Remarks.*—This species is common in Leyte, Mindanao, Palawan, and Busuanga. It is also known to occur in Culion, Dinagat, and Basilan, in the Philippines, and is reported from Celebes.<sup>20</sup> The species is always found in the immediate vicinity of water, usually perched on rocks, in midstream. The frogs are extremely agile, and can make phenomenal jumps. They are captured with no little difficulty.

The types were collected in the Philippines, probably by Hugh Cuming; the exact type locality appears to be no longer known. The types, three in number, are in the British Museum.

Genus **POLYPEDATES** Tschudi

*Polypedates* TSCHUDI, Class. Batr. (1838) 34; DUMÉRIE and BIBRON, Erp. Gén. 8 (1841) 515; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 77; COPE, Nat. Hist. Rev. (1865) 116; STEJNEGER, Bull. U. S. Nat. Mus. 58 (1907) 143.<sup>21</sup>

<sup>20</sup> Boulenger, Proc. Zool. Soc. London (1897) 193-237, does not include the species in the Celebes fauna. He states that Meyer's record, Abh. Mus. Dresden 2 (1887) 16, of *Rana natatrix* Gthr. from Gorontalo is probably wrong.

<sup>21</sup> Stejneger (loc. cit.) has shown the necessity of the use of *Polypedates* instead of *Rhacophorus* for this genus of frogs.

*Theloderma* TSCHUDI, Class. Batr. (1838) 32.

*Buergeria* TSCHUDI, Class. Batr. (1838) 34.

*Rhacophorus* TSCHUDI, Class. Batr. (1838) 34; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 530; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 116; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 73 and 74; Fauna Brit. India, Rept. (1890) 470.

*Trachyhyas* FITZINGER, Syst. Rept. (1843) 31.

*Dendricus* GISTEL, Naturg. Thierr. (1848) 8.

Pupil horizontal; tongue free and deeply notched behind; vomerine teeth rarely absent; tympanum either distinct or hidden, rarely the latter; fingers more or less webbed or free; toes more or less webbed, terminating in disks; a small bone inserted between last two phalanges; terminal phalanges T-shaped. Outer metatarsals separated by a web; omosternum and sternum with a bony style.

This large genus of frogs is widely distributed from India and Madagascar to China, southern Asia, and the East Indian Archipelago. More than fifty species are known. There are seven well-differentiated forms represented in the Philippine fauna.

*Key to the Philippine species of Polypedates Tschudi.*

- a*. Tympanum distinct; skin of head not involved in cranial ossification.
  - b*<sup>1</sup>. Fingers about one-third webbed; toes more than three-fourths webbed; cutaneous prominences below anus and on outer edge of arm and foot; heel reaches almost to tip of snout.
    - P. appendiculatus* (Günther).
  - b*<sup>2</sup>. Fingers about two-thirds webbed, membrane reaching disks of third and fourth fingers; toes webbed to base of disks; cutaneous flap over anus ..... *P. pardalis* (Günther).
  - b*<sup>3</sup>. Slight web at base of fingers; toes nearly entirely webbed; dorso-lateral glandular folds present..... *P. hecticus* Peters.
  - b*<sup>4</sup>. Slight rudiment of web at base of fingers; toes three-fourths webbed; no dorsolateral glandular fold; small tubercles below vent, at heel, and on outer edge of forearm and tarsus.... *P. everetti* (Boulenger).
- a*<sup>5</sup>. Tympanum distinct, large; skin of head involved in cranial ossification.
  - b*<sup>1</sup>. Slight rudiment of web at base of fingers; toes nearly entirely webbed; disks of fingers half the diameter of eye.... *P. macrotis* (Boulenger).
  - b*<sup>2</sup>. Differs from *P. macrotis* in having smaller choanæ and a narrower interorbital space; spotted above, or with four or six longitudinal stripes ..... *P. leucomystax* (Gravenhorst).
- a*<sup>6</sup>. Tympanum nearly hidden under skin, about half size of eye; fingers with rudiment of web; toes a little more than one-half webbed.
  - P. surdus* Peters.



*Polypedates appendiculatus* (Günther). Plate 8, figs. 2, 2a, and 2b.

*Rhacophorus appendiculatus* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 79; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 86, pl. 8, fig. 4; BOETTGER, Ber. Senck. Nat. Ges. (1886) 122; Abh. Ber. Mus. Dresden 7 (1894-95) 2.

*Description of species*.—(From No. 184, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., September, 1912, by E. H. Taylor.) Vomerine teeth in two converging series, beginning on anterior inner edge of choanæ, not especially distinct; choanæ not large; head distinctly longer than wide; eye prominent, its diameter slightly longer than distance from eye to nostril; canthus rostralis rounded, the area about nostrils forming two small rounded prominences, with a slight depression between them; forehead not concave; lores concave, sloping obliquely; snout somewhat triangular, constricted in front of nostrils, forming a distinct "nose;" diameter of tympanum equal to, or a little more than, half diameter of eye, very close to orbit, the distance separating them about one-fifth to one-sixth diameter of tympanum; distance of nostril to end of snout contained one and one-half times in its distance from eye; a very distinct skin fold from eye to arm above tympanum; skin rough, tubercular, or warty, especially on head, snout, and shoulders, and on sides of head about tympanum; skin on posterior part of back as well as on the limbs rather smooth; chin and chest smooth; belly and under aspect of thighs strongly granular; hand slightly less than one-third webbed; digits with broad disks, equal to, or slightly smaller than, tympanum; first finger shorter than second, fourth longer than second, reaching terminal disk of third; subdigital tubercles prominent; a very slight skin fold from base of third finger along inner arm; toes more than three-fourths webbed, the webs reaching to near base of disks on outer sides of toes; disks smaller than those on fingers; third and fifth toes of equal length; inner metatarsal tubercle well developed, outer indistinct or wanting; a decided, undulous skin fold along outer side of fifth toe and tarsus, and on outer part of forearm; two small cutaneous prominences below anus; hind limb brought forward, tibiotarsal articulation reaches to near tip of snout.

*Color in life*.—Above, light brownish lavender on head, back, and sides, and above limbs; two broad, rather irregular stripes of light pale lavender to whitish from eye to groin; below creamy white.

*Measurements of Polypedates appendiculatus (Günther).*

	mm.
Length, snout to vent	41
Length of head	15
Width of head	13.6
Length of snout	7.5
Diameter of eye	5.1
Diameter of tympanum	3.5
Diameter of finger disk	3.5
Foreleg	24.5
Hind leg	64
Tibia	22

*Variation.*—The chief variations noted in a series of about twenty specimens from Bunawan, Agusan, are as follows: The larger percentage of the specimens has the skin on the anterior part of the body smooth; in younger specimens the "nose" is not so distinctly evident; older specimens usually have a minute, but distinct, dermal fold on underside of head, outlining the mandible. The color varies markedly; half-grown and young specimens are usually uniform lavender above, and whitish below. Older specimens vary from purplish brown to gray, with indistinct spots and mottlings; the light lateral stripes are only rarely present; in certain specimens the hind legs are distinctly barred.

*Remarks.*—This species was especially common at Bunawan. The specimens for the most part were collected from the axils of the large caladiums that are found in profusion in the cut-over forests and along the rivers. Their eggs are deposited in the water that collects in the axils of caladiums and wild plantains.

The type locality is "Philippines," with no definite locality given. Known from Dinagat, Mindanao, and the Calamian Islands, in the Philippines. Reported also from Borneo.

*Polypedates pardalis* (Günther). Plate 4, fig. 1; Plate 6, figs. 2 and 2a.

*Rhacophorus pardalis* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 83, pl. 6, fig. D; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 91; BOETTGER, Ber. Senck. Nat. Ges. (1886) 123; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 449.

*Rhacophorus reinwartii* EYDOUX and SOULEYET, in Voy. Bonite, pl. 10, fig. 1.

*Rhacophorus rizali* BOETTGER, Abh. Ber. Mus. Dresden 7 (1898-99) 1.

*Description of species.*—(From No. 1410, E. H. Taylor collection; collected in swamp between Gibong and Simulao Rivers, Agusan, Mindanao, P. I., April, 1913, by E. H. Taylor.) Vomerine teeth in two straight, or slightly converging, series, arising

from anterior inner edge of the large, oval choanæ, and separated from each other by a distance greater than the length of one group; Eustachian tubes with large visible openings; tongue broad, very deeply notched, with rather long horns behind (male with internal vocal sac, the openings near inner angle of mouth); head distinctly broader than long; eyes rather prominent, interorbital width about one and one-half times the width of upper eyelid; canthus rostralis indistinct, rounded, rather concave between eye and nostril, making snout rather narrower behind nostrils than farther forward; nostrils on tip of snout; distance from nostril to end of snout contained in distance of nostril to eye about four times; lores sloping slightly, not or scarcely concave; snout high; a slight but distinct depression between nostrils and a slightly concave area in forehead; diameter of eye equal to its distance from nostril; tympanum large, distinct, separated from orbit by a distance less than one-half its diameter, and equal to a little more than half diameter of eye; a very slight supratympanic fold; skin above smooth, skin on head not involved in the cranial ossification; skin on belly and on lower aspect of thighs strongly granular; anal region covered with a broad flap of skin, which is free to tip of coccyx; very broad disks on ends of broad flat fingers, diameter of disks of two outer fingers larger than tympanum and more than two-thirds eye; fingers broadly webbed; web between first two digits extends from subarticular tubercle of first to slightly above that of second; web between other fingers extends to base of disks; a large, very hard tubercle at base of first finger, about one-third the length of digit; a distinct skin fold from base of third finger along inner side of arm to its insertion; a very slight fold on outer edge of fourth finger, continued on outer side of forearm; no trace of webs on hind leg; toes webbed to base of disks, which are smaller than those of fingers; fifth toe longer than third; a slight fold along outer side of fifth toe continued to heel; heel with a slight dermal fold; fingers and toes with decided kinks at upper base of disks, and a slight triangular depression on upper part of each disk; tibiotarsal articulation fails slightly to reach nostril.

*Color in life.*—Above, head and body and sides light reddish to orange brown with slightly darker brown markings; a darker brown band between eyes; entire upper surface speckled and mottled with brilliant orange-yellow spots and blotches, more numerous on shoulders; limbs yellow, with darker distinct broad bands of brown, and on the broader yellow interspaces single narrow brown lines with numerous small brown dots; digits and



fingers dusky; a rather distinct brown line from anus to knee on hinder part of thigh; anal flap dusky with numerous small dark brown dots; below anus a large white spot, below which are scattered brown dots; membrane between toes yellowish with dusky markings, most noticeable between outer toes and fingers, usually an orange spot in the middle of the dark area; a dark brown line along the skin fold on outer side of hand and foot; chin, belly, and underside of limbs canary to lemon yellow; chin with a few brown spots outlining edge of mandible; a few dusky spots on sides near groin.

*Measurements of Polypedates pardalis (Günther).*

	mm.
Length, snout to vent	65
Length of head	23.5
Width of head	25.6
Depth of head, in front of eye	7.2
Diameter of tympanum	5
Diameter of eye	7.3
Length of snout	11
Foreleg	41
Hind leg	106
Width of toe disk	5.5
Tibia	36

*Variation.*—A male taken at the same time is much smaller, and strikingly different in color. Length, snout to vent, 55 millimeters. The ground color is bright orange yellow with a very narrow, irregular line across the eyes and another, slightly wider and more irregular, across snout in front of eyes; a dim irregular light brown blotch between shoulders and another small group of dark dots on middle of back; entire upper surface with scattered, small, round, brown dots; limbs dotted or with short irregular lines; barring on limbs not or scarcely evident. The webs between toes slightly shorter; that is, the web does not reach the disks, except on outer side of second and third toes. The webs between fingers are also shorter, not reaching the disks on any of the fingers.

A specimen from Luzon shows some slight differences. I append a rather complete description (No. 10, Bureau of Science collection). Vomerine teeth in two short series arising from anterior inner edge of choanæ, not curving, converging but slightly, and widely separated from each other; Eustachian tubes with large visible openings near inner angle of mouth; tongue broad, deeply notched behind; head as broad as long; eyes prominent; deep interorbital region, its width a little greater than the width of one eyelid; canthus indistinct, rounded, not

or but very slightly concave between eye and nostril; snout not squarish, but sloping from nostrils to a low slight point; distance of nostril from end of snout contained about twice in distance of nostril to eye; lores sloping greatly, not or but slightly concave; diameter of eye reaches to half the distance between nostril and end of snout; tympanum distinct, scarcely more than half the diameter of eye, partly covered by the distinct skin fold which continues from eye to arm; distance of tympanum from eye equals about one-third its diameter; skin smooth above, skin of head not attached to head bones; sides of neck very slightly granulate; strongly granulate on belly and on underside of thigh; a flap of skin over anus free about halfway to end of coccyx; digits of hand with broad disks; webs between first two fingers up to subarticular tubercle; web of second finger on outer side extends to base of disk, but fails to reach base of disk of third finger; web between third and fourth fingers also fails somewhat to reach disks; first finger shorter than second, which in turn is shorter than fourth; large tubercle on thumb nearly equal to half length of the digit; a slight web from base of third finger along inner side of arm; disks of toes smaller; toes webbed, the web failing to reach disks on inner side of second and on either side of third; dermal fold on fifth toe and on foot very slight; cutaneous appendage on heel prominent; tibiotarsal articulation fails to reach nostril.

*Color in alcohol.*—Dusky, with a large, dim, irregular brown spot on occiput partly involving the supra- and interocular areas, and another large brownish blotch on posterior part of back; large yellowish white spots on shoulders, and an occasional whitish spot on back, more numerous on sides and in sacral region; limbs dimly barred with dusky, with an occasional whitish spot; white spot below anus; web between last fingers and toes with dusky marks; below without markings.

*Measurements of Polypedates pardalis (Günther).*

	mm.
Total length, snout to vent	60
Width of head	21
Length of head	22
Diameter of eye	7.2
Diameter of tympanum	3.5
Depth of head, in front of eye	4.8
Foreleg	42.5
Hind leg	95
Diameter of toe disk	4.8
Snout, length	9.8

*Remarks.*—This specimen differs from the Mindanao specimen by the following characters which appear very slight: Nostril not so near end of snout; snout not so high, lores sloping more; end of snout not so truncate; tympanum nearer eye; eye-to-arm fold more distinct; distance of eye and nostril from mouth less; tympanum somewhat smaller; the webbing of feet and toes agrees with that in the male described from Mindanao save that on one or two fingers the web reaches the disk on one side.

That *Rhacophorus rizali* Boettger is a synonym of this species is scarcely to be doubted.<sup>22</sup> A photograph of the type specimen in Germany is in my collection. It agrees very well with my Mindanao specimens.

The two Mindanao specimens, a male and a female, were copulating when taken. They were found on the side of a tree about 3 meters from the ground, just above a small cavity filled with water. No eggs were found. The two forms were so strikingly different in coloration and size that it seemed two species were at hand. It is certainly a rare species in Agusan Valley. Although remarkably familiar with the fauna and flora of the forests, the natives to whom these specimens were shown had never seen the species.

*Polypedates macrotis* (Boulenger).

*Rhacophorus macrotis* BOULENGER, Ann. & Mag. Nat. Hist. VI 7 (1891) 282; VI 14 (1894) 87.

*Description of species.*—(From Boulenger.) “Vomerine teeth in two oblique groups on a level with the front of the choanæ, which are very large. Head nearly as long as broad; skin adherent to the frontoparietals, which are rugose, studded with granules; snout triangular, a little longer than the diameter of the orbit; canthus rostralis angular; loreal region concave; nostril near the tip of the snout; interorbital space (in the middle) not wider than the upper eyelid, the frontoparietal bones narrowing posteriorly; tympanum very distinct, as large as the eye. Fingers long, with a distinct rudiment of a web; toes nearly entirely webbed; disks of fingers about half the diameter of the eye, of toes smaller; subarticular tubercles moderate; a very small inner metatarsal tubercle. Tibio-tarsal articulation reaching the tip of the snout; tibia half as long as head and body. Skin smooth, granular on belly and under thighs.”

*Color.*—“Grey-brown above, with a few small dark brown spots; loreal region greyish white; a dark brown band from the end of the snout through the nostril, the eye, and the tympanum to

<sup>22</sup> See Zool. Record, Rept. (1897) 30.



the side of the body; on the tympanum this band expands into a large temporal blotch; limbs with ill-defined dark cross bands; hinder side of thighs brown, dotted with white; lower parts whitish speckled with brown.

"From snout to vent 78 millim."

*Remarks.*—This species was described from a female specimen from Baram, Borneo. It belongs to the group of *Polypedates maculatus*. "It differs from all the species of that group in the larger tympanum, from *R. maculatus* and *R. cruciger* in the absence of a parieto-squamosal arch, and in the larger choanæ, from *R. leucomystax* in the narrower interorbital space and the larger choanæ, and from *R. Colletti* in the shorter hind limbs." (*Boulenger*.)

From the Philippines this species is known only from Palawan, where it was obtained by A. Everett.

*Polypedates hecticus* Peters.

*Polypedates hecticus* PETERS, Mon. Berl. Ak. (1863) 457.

*Rhacophorus hecticus* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 78; BOETTGER, Ber. Senck. Nat. Ges. (1886) 122; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1896) 448; FLOWER, Proc. Zool. Soc. London (1899) 898 (uncertain).

*Description of species.*—(From the type description.) Vomerine teeth in two oblique converging series between the choanæ; tongue cordiform; openings of the Eustachian tubes larger than choanæ; head almost one-fifth longer than broad, flat, with protruding eyes; diameter of eyes nearly as great as length of snout; snout projecting, rounded in front of nostrils; frenal region concave; nostril nearer tip of snout than eye; canthus rostralis distinct; tympanum very distinct and large, distinctly longer than high, about two-thirds the diameter of eye; skin on back granulated; a well-defined dorsolateral fold present from eye to end of body; a fold from corner of mouth, below tympanum, to axilla; forearm reaching end of body with longest finger; disks of fingers very large, broadly cordiform in shape, rather pointed anteriorly; a slight web present at base of fingers; first finger shorter than second, with smaller disk; subarticular tubercles well developed; a skin fold on inner side of arm; fifth toe longer than third; toes almost entirely webbed, the membrane not including last two joints of fourth toe; disks similar to those on fingers, but smaller; two metatarsal tubercles; a fold of skin on outer toe; tibiotarsal articulation reaches beyond end of snout; skin granular or tubercular above. Male without vocal sac.

*Color.*—Above grayish blue, the fold on back white, bordered

by black; a white line from tip of snout along upper lip, widening below and in front of tympanum and continuing to insertion of arm; dark spots on temporal region, one in front, one behind tympanum, which sharply defines the light line; pale blue low on sides, with small blackish flecks; limbs brownish with more or less distinct flecks, especially on posterior aspect of thigh; below on body, white.

*Measurements of Polypedates hecticus Peters.*

	mm.
Total length	51
Length of head	17
Width of head	14
Foreleg	35
Hand, with third finger	17
Hind leg	84
Foot, with fourth toe	37

*Remarks.*—The type, which appears to be the only specimen recorded from the Philippines, is a full-grown male specimen collected at Loquilocum, Samar, by F. Jagor.

Flower has reported a frog which appears to be a specimen of this species, from Malay Peninsula, but expresses a doubt as to whether it is correctly classified.

*Polypedates everetti* (Boulenger).

*Racophorus everetti* BOULENGER, Ann. & Mag. Nat. Hist. VI 14 (1894) 87.

*Description of species.*—(From Boulenger.) “Vomerine teeth in two oblique groups between the moderately large choanæ. Head slightly broader than long, without dermal ossification. Snout rounded, shorter than the diameter of the orbit; canthus rostralis obtuse, curved; loreal region concave, very oblique; nostrils near the end of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, two fifths the diameter of the eye. Fingers with a slight rudiment of web; disks moderate, nearly as large as the tympanum; toes three-fourths webbed; inner metatarsal tubercle very small; no tarsal fold. Tibio-tarsal articulation reaching a little beyond the tip of the snout. Skin finely granulate above, coarsely beneath; small conical tubercles below the vent, at the heel, and along the outer edge of the forearm and tarsus. Pale yellowish or reddish brown above, with dark brown markings; the most conspicuous of these are a cross band between the eyes and a symmetrical marking on the præsacral part of the back, roughly representing a frog with the four limbs stretched out; limbs with dark cross bands; lower parts uniform white.

"From snout to vent 32 millim."

*Remarks.*—This rare species is known from two specimens collected by A. Everett in Palawan.

*Polypedates leucomystax* (Gravenhorst). Plate 2, fig. 4.

*Hyla leucomystax* GRAVENHORST, Delic. Mus. Vratislav. (1829) 26.

*Hyla sexvirgata* GRAVENHORST, Delic. Mus. Vratislav. (1829) 28.

*Hyla quadrilineata* WIEGMANN, Nova Acta Acad. Leop.-Carol. 17 (1835) 260, pl. 22, fig. 1.

*Polypedates leucomystax* TSCHUDI, Class. Batr. (1838) 75; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 520; KELAART, Prodr. Faun. Zeyl. (1852), 193; STEJNEGER, Bull. U. S. Nat. Mus. 58 (1907) 157.

*Polypedates rugosus* DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 520.

*Polypedates quadrilineatus* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 79.

*Polypedates megacephalus* HALLOWELL, Proc. Acad. Nat. Sci. Philadelphia (1860) 507.

*Rhacophorus maculatus* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 83; var. *quadrilineata*, 84; Proc. Zool. Soc. London (1889) 30.

*Polypedates maculatus* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 78; Rept. Brit. India (1864) 428; BLANFORD, Journ. As. Soc. Bengal (1870) 376; ANDERSON, Proc. Zool. Soc. London (1871) 307; STOLICZKA, Proc. As. Soc. Bengal (1872) 106.

*Polypedates biscutiger* PETERS, Mon. Berl. Ak. (1871) 644.

*Hylorana longipes* FISCHER, Archiv. Naturg. 51 (1885) 47.

*Rhacophorus leucomystax* var. *sexvirgata* BOULENGER, Proc. Zool. Soc. London (1889) 30.

*Description of species.*—(From No. 686, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., June 24, 1913, by E. H. Taylor.) Vomerine teeth in two slender diagonal series, beginning at some distance from anterior inner edge of choanæ, and separated from each other by a distance equal to their distance from choanæ; distance between Eustachian tubes equals their distance from nostrils; distance between choanæ much greater than distance between nostrils, equaling distance from eye to nostril; head a little longer than broad; interorbital area and a large area on snout depressed; canthus rostralis roundly angular, nostrils lateral, below level of choanæ; diameter of eye equal to its distance from nostril; nostril two and one-half times as far from eye as from tip of snout; tympanum large, its greatest diameter slightly less than diameter of eye, separated from the latter by a distance less than one-third its diameter; interorbital distance one and one-half times upper eyelid; latter equal to distance between nostrils; skin of body above minutely granular and apparently smooth in patches; skin of head, save a small area in frontal region, involved in cranial ossification; sides wrinkled and granular; throat and breast



nearly smooth; belly very strongly granular, part of femur less so; a strong glandular fold from eye, curving above tympanum, then running backward and slightly downward some distance on side; this does not reach below the middle level of tympanum; fingers broad, all except first with large disks, that on first finger small; each digit with a deep groove around edge and a slight groove across face of disk; a very strong kink at base of disk; a rudiment of web at base of fingers very distinct; a distinct skin fold from base of third finger, continued above along inner arm; subarticular tubercles of hand very strong; first finger a little shorter than second; fourth finger reaching more than halfway on disk of third; a slight fold on outer side of fourth finger and outer side of forearm; toes from one-half to two-thirds webbed, membrane not reaching base of disks; disks smaller than finger disks; subarticular tubercles rather distinct; a blunt inner metatarsal tubercle and a very obscure outer; a very dim fold on outer side of fifth toe and tarsus; tibiotarsal articulation reaching slightly beyond tip of snout.

*Color in life.*—Above olive brown, with four darker brown, broken, irregularly widened stripes, two beginning on tip of snout and two on the eyelids; loreal region dark brown, lighter on lip; a broad dark stripe beginning behind tympanum and continuing some distance on side; legs barred with darker brown; posterior aspect of thigh brown, dotted with yellow; below yellow-cream; throat with dusky brown flecks; posterior part with canary yellow wash; sides brown, reticulated with yellow-cream; palms and soles purplish.

*Measurements of Polypedates leucomystax (Gravenhorst).*

	mm.
Length, snout to vent	81
Length of snout	13
Length of head	32
Width of head	29
Diameter of eye	8.5
Diameter of tympanum	7.5
Eye to nostril	9
Interorbital distance	10.5
Foreleg	51
Longest finger	23
Hind leg	148
Femur	41
Tibia	43.5
Foot	51.5
Longest toe	36
Finger disk	4.7
Toe disk	3.5

*Variation.*—The large synonymy is evidence of a great amount of variation in this species. In Philippine specimens the color and markings vary greatly; but relative measurements and proportions are rather constant, save in the case of the tympanum, which varies from one-half to nearly full size of the eye.

The markings are usually in four to six longitudinal lines, as described above (*Polypedates quadrilineatus*), or broken into numerous spots which do not conform to the outline of this design (*P. maculatus*); spots may be numerous or few, sometimes almost wanting. The ground color varies from very light yellow or whitish to dark purplish brown; sometimes (in life) almost black, with no markings visible. One of my specimens, taken in Mindanao, was bright lemon yellow over the entire body when first captured, with no markings. After being kept some time the yellow became grayish, and dim longitudinal stripes appeared.

Wiegman had a Manila specimen collected by Meyer for the type of his *Hyla quadrilineata*. One of the types of *Polypedates rugosus* Duméril and Bibron was from Manila.

It is significant that the *Polypedates maculatus* form is rarely, if ever, found in Mindanao; in a collection of more than fifty specimens from Bunawan not one occurs. On the other hand, Manila specimens are largely of that type.

*Tadpoles.*—Mandibles broadly edged with black, the upper forming a strongly arched, curved series, the lower a strongly V-shaped series; lower edge of lip with numerous papillæ; upper labial extension with four series of mandibular teeth, the first uninterrupted, the second barely interrupted medially, the other two series very short, separated by mouth; lower labial extension with three uninterrupted series.

*Color.*—Yellowish brown to olive brown above, with black spot on nose and nostrils; a bright yellow spot on point of snout, purplish on throat, lighter on belly; tail olive, the crests colorless.

It will be noted that these specimens differ from Flower's description, in that in the form described above there are only four instead of five series of small teeth on upper lip, and that the three series on lower lip are uninterrupted. Flower<sup>23</sup> also mentions a variation in a Singapore specimen. It may be possible to differentiate the various races or subspecies of *Polypedates leucomystax* by the characters of the tadpoles.

*Remarks.*—The species occurs over the entire Archipelago; it has been reported from many localities in Luzon, and from

<sup>23</sup> Proc. Zool. Soc. London (1899) 899.

Mindoro, Samar, Leyte, Negros, the Calamianes, Mindanao, and Palawan. I failed to get specimens in the Sulu Archipelago; but it very probably occurs there as I found specimens in Zamboanga, and in Borneo on the coast nearest the southern end of the Sulu Archipelago.

There appears to be no definite breeding season for the species. In Baguio, northern Luzon, I found floating masses of fertile eggs in December and May. In Manila I have found them in June and July. In Mindanao a number of egg masses were collected from branches above pools of water in September. One mass taken contained seven hundred eighty-six eggs.

*Polypedates surdus* Peters.

*Polypedates surdus* PETERS, Mon. Berl. Ak. (1863) 459.

*Rhacophorus surdus* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 79; BOETTGER, Ber. Senck. Nat. Ges. (1886) 122; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 449.

*Description of species.*—Vomerine teeth in two short oblique series, beginning on inner edge of choanæ and lying between and behind them; tongue cordiform, very deeply notched behind; choanæ smaller by almost one-half than openings of Eustachian tubes. Head as broad as long; distance between anterior corners of eyes equal to their distance from point of snout; canthus rostralis distinct; distance between nostrils equal to their distance from eye; nostrils nearer end of snout than eye; loreal region concave; tympanum entirely covered, but its outline more or less visible, the diameter equaling about half the eye; diameter of eye shorter than snout; foreleg reaches almost to back end of body; fingers with rudiments of a web; finger disks large, rounded, that on first finger small; first finger shorter than second, fourth longer than first or second; subarticular tubercles and carpal tubercles large; tibiotarsal articulation reaches tip of snout; toes a little more than half webbed, last two joints of fourth and last joints of the others free; disks of toes larger than those of fingers; fifth toe very little longer than third; subarticular tubercles and the two metatarsal tubercles well developed; skin with a few small tubercles above; below, entire surface granular.

*Color.*—Above dark brown; a small stripe on point of snout and a larger one on lip in front of eye; a greenish white stripe from eye to axilla; sides of body whitish, marbled with brown; below brownish, throat speckled with yellowish; legs with brown bars; posterior aspect of thigh marbled with brown.



*Measurements of Polypedates surdus Peters.*

	mm.
Length, snout to vent	26
Length of head	10
Width of head	10.5
Foreleg	19.5
Length of hand, with third finger	9
Hind leg	43
Foot and fourth toe	19.5

*Remarks.*—The species was discovered in Luzon by F. Jagor. It appears to have been founded on a single specimen, and I believe it has not been rediscovered in the Islands.

Genus *HAZELIA* novum

Upper jaw with teeth; no vomerine teeth; head with well-defined bony ridges; a low supratemporal ridge; tympanum distinct; no ridges across palate in front of oesophagus; fingers unwebbed, with large disks; a distinct kink above disk, caused by a bone intercalated between last two phalanges; terminal phalanges bifurcate; body covered with spiny tubercles; toes partly webbed; pupil horizontal. This genus is named for my wife, Hazel Clark Taylor, who has assisted me greatly in making collections and in the preparation of this work.

Type, *Hazelia spinosa* sp. nov.

This genus combines certain characters of *Philautus* and *Polypedates*; it has the intercalated bone between the last two phalanges on each digit; the vomerine teeth are wanting as in *Philautus* (rarely wanting in *Polypedates*); the terminal phalanges are bifurcate, shaped something between a Y and a T; the bony crests on head are not unlike those found in certain species of *Bufo*.

*Hazelia spinosa* sp. nov. Plate 7, fig. 1.

*Type.*—No. 406, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., August, 1912, by E. H. Taylor.

*Description of type.*—No vomerine teeth present; choanæ large, elongate, lying somewhat back under edge of jaw, but plainly visible; tongue elongate, divided behind, with two small rounded "horns;" no papilla present; head longer than wide; snout rather truncate, high, sloping downward and backward toward mouth, upper part extending farther forward than mouth; snout with distinct, prominent canthus rostralis; rather concave between eye and nostril; snout slightly narrower behind nostrils

than elsewhere; loreal region rather concave, lores rather vertical on upper part, then sloping to mouth; nostrils very near tip of snout, distance of nostril from tip contained in distance to eye four or five times; eye large, its diameter about equal to its distance from nostril; tympanum very distinct, lying very close to eye, its diameter about four-fifths that of eye; two bony ridges form continuations of the canthi, beginning in front of eye and continuing on either side of interorbital region to occiput; distance between ridges greatest anterior to eye; interorbital region depressed, its width about one and one-half to one and two-thirds times as great as upper eyelid; a slight ridge above tympanum; temporal region slightly concave; fingers unwebbed, with distinct, transversely widened disks; each disk with a distinct groove around outer edge, continuous with a transverse groove crossing near middle of disk below; a decided kink between last two phalanges; first finger shorter than second, which in turn is much shorter than fourth; fourth finger reaches base of disk of third; toes about one-third to one-half webbed, the membrane reaching subarticular tubercle of first and second toes, and a little higher on third; third and fifth toes of unequal length; disks of toes smaller than those of fingers; subarticular tubercles well developed; a prominent inner, and a small outer, metatarsal tubercle; tibiotarsal articulation reaching slightly beyond tip of snout, when carried forward; skin above covered with hard, spiny granules and tubercles, giving a very spiny appearance; skin of anterior part of head grown solidly to skull and bony ridges; tubercles are present on upper surface of limbs and fingers, on side of head, and even under digits; eyelids extremely rugose; chin with minute tubercles; belly granulate; inner aspect of thighs and tibia smooth.

*Color in life.*—Above brownish, darker on anterior part of head, with scattered lemon yellow to orange spots; two prominent darker-edged interscapular orange spots above and slightly behind tympanum; smaller yellow spots in superciliary region, along lip and canthus rostralis, below tympanum and along both sides of back; one small prominent spot on tip of snout; limbs above brownish; reddish orange on anterior and posterior aspects of arms and legs, with two yellow darker-edged spots on arms, and larger, rather regularly disposed yellow spots on legs; belly, sides, and undersides of limbs orange yellow; fingers and toes with yellow spots.

*Measurements of Hazelia spinosa sp. nov.*

	mm.
Total length, snout to vent	41
Width of head	13
Length of head	16
Diameter of eye	5.2
Diameter of tympanum	4
Foreleg	26
Longest finger	13
Hind leg from vent	67.5
Femur	21
Tibia	22
Foot and heel	26
Longest toe	15

*Variation.*—The specimen here described was collected in Bunawan, Agusan, Mindanao, in 1912. In 1917 I discovered the species in Basilan, at a point on the west coast directly opposite the small island of Great Govenen. Most of the specimens taken were darker than the Agusan specimen, their bellies were orange, with numerous rather large yellowish white spots on sides of the belly and chin. The number and prominence of the dorsal yellow spots vary, some specimens having very few spots on head and legs; the spiny granules on heels and below anus are yellowish. In the type the third toe is distinctly longer than the fifth; in Basilan specimens they are equal or nearly so, and the distance from nostril to tip of snout is less.

*Tadpoles.*—A few tadpoles of this species were taken with the adults; also an immature specimen, which had just completed its transformation.

*Description of tadpole.*—Length, with hind legs, 6.5 millimeters; body nearly one and a half times as long as broad, but much shorter than tail; depth of tail in tail length more than four times; nostrils much nearer end of snout than eye; eyes on upper surface of body; distance between them equal to their distance from nostrils; a deep trough-shaped groove between and behind eyes, continued forward as a narrow linear groove to end of snout; in front of eyes, and somewhat below, are two large rounded pouches; mouth narrow; inside the mouth, and almost concealed, are two series of teeth which are a deep dark brown; the upper is curved with only a very small angle; the lower series rather V-shaped; these teeth plates seemed to be wanting in older specimens of the tadpoles. The specimens are in a rather indifferent state of preservation, and I am unable to determine the character of the upper and lower labial teeth.



*Color in life.*—Dark brown to black; belly rather lighter; older specimens have minute yellow spots, and by the time the anterior limbs have sprouted, the shoulder spots are evident.

*Remarks.*—The adults and tadpoles from Basilan were taken in a small hole filled with water and rotting leaves in a tree trunk about one-half meter from the ground. No specimens had been observed, but when the hole was emptied the adults and tadpoles were taken from the bottom. The adults are very active and jump with great rapidity; it is probable that their apparent rarity is due to the fact that for the most part they are arboreal; they feed largely on ants. It is noteworthy that among the leaves and trash found in the water there were great numbers of aquatic ants. In the character of the finger disks this species resembles *Polypedates*. None of the specimens appears to have vocal sacs.

The species is known only from Bunawan, Agusan, Mindanao, and Basilan, in the Philippines.

#### Genus PHILAUTUS Gistel

*Philautus* GISTEL, Naturg. Thierr. 10 (1848); STEJNEGER, Proc. U. S. Nat. Mus. 28 (1905) 346;<sup>24</sup> BARBOUR, Mem. Mus. Comp. Zool. Harvard Coll. 44 (1912) 69.

*Ixalus* DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 523; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 74; COPE, Nat. Hist. Rev. (1865) 116; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 93.

*Orchestes* TSCHUDI, Class. Batr. (1838) 76.

*Leptomantis* PETERS, Mon. Berl. Ak. (1867) 32.

"Pupil horizontal. Tongue free and deeply notched behind. Vomerine teeth none. Tympanum distinct or hidden. Fingers free or webbed at the base; toes webbed; tips of fingers and toes dilated into regular disks. Outer metatarsals separated by a groove or narrow web. Omosternum and sternum with a bony style. Terminal phalanges obtuse." (*Boulenger.*)

*Remarks.*—This genus is closely related to *Polypedates* Tschudi and *Staurois* Cope. External differences between the species of the genera are indeed meager, as certain *Polypedates* have no vomerine teeth and these are also wanting in *Staurois*. The Philippines are rich in species of this genus, no less than seven having been described heretofore, and two new ones are included in this catalogue, both quite clearly differentiated from other known forms.

<sup>24</sup> Stejneger has shown that this name must take precedence over *Ixalus* Duméril and Bibron, which is preoccupied by *Ixalus* Ogilby, 1836, for a genus of mammals.

Key to the Philippine species of *Philautus* Gistel.

- a*<sup>1</sup>. Fingers free; first finger shorter than second, not opposed to others.  
*b*<sup>1</sup>. Toes webbed at base.  
*c*<sup>1</sup>. Heel reaches beyond tip of snout; snout with conical projection; tympanum dim, less than one-half eye; interorbital space wider than eyelid; skin shagreened above; 29 mm; Mindanao. *P. woodi* Stejneger.  
*c*<sup>2</sup>. Heel reaches eye; snout rounded; tympanum dim, about one-third of eye; interorbital space equals upper eyelid; tubercle on eyelid and heel; skin entirely smooth above; male with vocal sacs; 34 mm; Canlaon Volcano, Negros. *P. hazelæ* sp. nov.  
*b*<sup>2</sup>. Toes one-third webbed.  
*c*<sup>1</sup>. Heel reaches beyond tip of snout; tympanum hidden; skin shagreened above; interorbital space broader than eyelid; 20 mm; Leyte *P. leitensis* (Boulenger).  
*c*<sup>2</sup>. Heel reaches nostril or tip of snout; skin smooth above; tympanum distinct, one-third to two-fifths eye; 29 mm; Mount Dulangan, Mindoro *P. mindorensis* (Boulenger).  
*b*<sup>3</sup>. Toes one-half webbed. Heel reaches far beyond tip of snout.  
*c*<sup>1</sup>. Two converging ridges on shoulders; skin rough; tympanum distinct, equaling two-fifths eye; interorbital space wider than eyelid; male with vocal sac; 21 mm; Palawan. *P. longierus* (Boulenger).  
*c*<sup>2</sup>. No converging ridges; skin smooth; tympanum one-fourth size of eye; 18 mm; Mindoro. *P. schmackeri* (Boettger).  
*b*<sup>4</sup>. Toes nearly entirely webbed; snout pointed; tympanum small, covered with skin; skin smooth, with granules on back and eyelid; 22 mm; eastern Mindanao. *P. acutirostris* (Peters).  
*a*<sup>2</sup>. Fingers partially webbed; first finger shorter than second and opposed to third and fourth.  
*b*<sup>1</sup>. Fingers one-third to one-half webbed; first opposite rest; toes nearly entirely webbed; tympanum one-third eye, covered with skin; male with vocal sac; 34 mm; Agusan River, Mindanao. *P. bimaculatus* (Peters).  
*b*<sup>2</sup>. Fingers not more than one-fifth webbed; first two opposite third and fourth; toes two-thirds webbed; tympanum distinct, about three-fifths eye; skin smooth; 39 mm; Bongao, Sulu Archipelago. *P. montanus* sp. nov.

*Philautus woodi* Stejneger.

*Philautus woodi* STEJNEGER, Proc. U. S. Nat. Mus. 28 (1905) 346.

*Description of species.*—(From Stejneger.) "Snout longer than diameter of eye, with a pointed conical projection forming a distinct 'nose'; nostrils located nearer the tip of the snout than the eye; canthus rostralis sharp; lores very concave, the concavity continued forward beyond the nostrils; interorbital space wider than upper eyelid; tympanum scarcely distinguishable, apparently not larger than half the diameter of the eye; fingers free, first

considerably shorter than second, which is to the same extent shorter than fourth; disks of fingers rounded, large, especially those of third and fourth fingers; toes webbed at base only; disks well developed, about the size of those of second finger; subarticular tubercles well developed; a small oval inner metatarsal tubercle, no outer; no tarsal fold; hind legs being carried forward along the body, the tibio-tarsal articulation reaches a considerable distance beyond the tip of the snout; skin finely shagreened above, coarsely granular on the entire lower surface, including the throat, underside of limbs, and even hands and feet; a strong glandular fold from eye to shoulder; no dorso-lateral fold."

*Color*.—(In formalin and transferred to alcohol.) "Above dark chocolate brown, with a hair fine pale line from tip of snout along the entire middle line of the body; snout from tip to a line across the middle of upper eyelids pale cinnamon in strong contrast; a large dusky mark behind this pale area on the interorbital space and involving the upper eyelids, though visible only with difficulty on account of the dark color of the rest of the upper surface; whole loreal and temporal area dark brown, apparently a shade darker than the back; flanks, anterior and posterior aspects of the thighs, underside of tibia and foot with a strong suffusion of a deep saturated burnt sienna; underside whitish with a number of irregular spots or patches of brown; a few irregular white spots on the sides of the body."

*Measurements of Philautus woodi Stejneger.*

	mm.
Total length, from tip of snout to vent	29
Width of head	12.5
Foreleg	19
Hind leg, from vent to tip of longest toe	55

*Remarks*.—Stejneger records variations in a second specimen as follows: "The entire dorsal surface is of the same color as the prefrontal area, so that the sides are marked by a very broad dark brown band from the nostrils backward. The transverse dark frontal band consequently also stands out in strong contrast." It is presumably most closely related to *Philautus leiten-sis* from Leyte. It differs in the long acuminate and projecting snout, and the lesser extent of the webbing of the toes. The color is different. The types were collected on Mount Apo, Davao, Mindanao, at an elevation of nearly 2,000 meters, by E. A. Mearns, June 20, 1904. They are at present in the United States National Museum. The species has not been rediscovered.



*Philautus hazelæ* sp. nov. Plate 3, fig. 2.

*Type*.—No. F293, E. H. Taylor collection; collected at an elevation of about 1,000 meters, on Canlaon Volcano, central northern Negros, P. I., December 25, 1916, by E. H. Taylor.

*Description of type*.—Vomerine teeth wanting; choanæ very small, near outer edge of the palate; tongue oval, the anterior part forming a rounded moundlike prominence, notched behind, forming two distinctly rounded horns, widely separated at base; head short, neither snout nor occipital region concave; canthus rostralis distinct, rather angular; loreal region concave, sloping obliquely to mouth; eye large, pupil horizontal, diameter of eye slightly less than distance from eye to end of snout; nostril much nearer end of snout than eye; distance between nostrils equals their distance from eye; interorbital space about equals width of upper eyelid; tympanum, one-third to two-fifths the diameter of eye; skin of body, above, smooth, shiny; sides, belly, and underpart of thighs strongly granular; chin and underpart of arms smooth; a single, distinct rounded tubercle on posterior part of eyelid; a supratemporal fold from eye to arm; a short glandular fold behind and below tympanum, at angle of mouth, and another short fold above and in front of arm; a very prominent tubercle at end of tibia, with several smaller tubercles about it; fingers quite free with large transversely oval pads, much larger than tympanum; first finger only about two-thirds second, its disk very small but a little larger than the subarticular tubercles; second finger shorter than fourth; disk of fourth barely reaches base of disk of third; subarticular tubercles well developed, tubercles on palm not well defined; toes with a trace of web; toes with disks of unequal size; disk on fourth toe largest, but not equal to size of largest finger disk; an elongate tubercle on inner metatarsus, more than half the length of first toe; a very dim outer metatarsal tubercle; fifth toe longer than third; tibiotarsal articulation when brought forward reaches eye or a little beyond; each disk with a distinct groove around edge. Males with internal vocal sacs.

*Color in life*.—Above dark brown with a large, more or less regular, slate-black mark on back; head with a triangular spot on interorbital region; two elongate curving stripes on back; legs and digits barred with brown; belly bright canary yellow, mottled, reticulated, and spotted with brown; posterior part of belly and underpart of limbs and sides brown, with minute yellow punctations; labial region above with darker marks, below

bordered by a rim of small irregular cream dots; groin with larger blotches of yellow.

*Measurements of Philautus hazelæ sp. nov.*

	mm.
Length, snout to vent	34
Length of head	13
Width of head	14
Length of snout, from eye	5
Depth of snout, in front of eye	4.8
Diameter of eye	4.9
Diameter of tympanum	1.7
Diameter of largest finger disk	2.2
Foreleg	21.5
Longest finger, from wrist	11.1
Hind leg	53.5
Femur	17
Tibia	17
Longest toe, from metatarsal tubercle	16.8

*Variation.*—Color variations are very marked; practically no two specimens in my collection can be found alike. Several resemble the type in color and markings. No. F290 is gray, darker on loreal region, with a dim stripe on interorbital region; very dim, darker bars on limbs; belly grayish, with minute spots or reticulations of yellow; groin with yellow spots. Nos. F287, F297, F299, and F301 resemble No. F290 in general details. No. F296 is dark black-brown above, with an orange stripe from tip of snout to anus; below dusky brown, yellowish in groin. No. F291 is of a uniform pinkish drab color, with a few scattered black spots; irregular black stripes on both sides, strongly contrasted with the back color; yellowish below, with dusky markings; yellow spots in groin. No. F285 has the ground color gray, with a broad black band across head behind eyes, and a narrow one in front of eyes; a third shorter transverse stripe on shoulders, and another in the middle of the back, front limb strongly barred, hind limb dimly barred; groin with distinct yellow spots.

Although the type does not show them, many of the specimens have two small, rounded, distinct tubercles on shoulders, separated by a distance a little greater than the interorbital distance; occasionally a second pair is visible in the posterior third of back, more widely separated than the anterior pair; the tubercles on eyelid and on heel are constant. Most of the specimens have a small glandular swelling on the tip of the lower jaw. Some have the chin smooth; others granular, but with granules smaller than those of belly and thigh. In numerous specimens there

are faint raised rugosities in the place where the vomerine teeth usually appear, which in one or two cases have the appearance of slight series of vomerine teeth. This again emphasizes the fact that the vomerine teeth are not in themselves a generic character, and in many cases they cannot be relied upon even as a specific character.

A specimen recently captured in Culasi, Antique Province, Panay, in the mossy forest at 1,000 meters, by R. C. McGregor, is worthy of note; the eye has more than one tubercle, and the two pairs of tubercles on the back are quite distinct. In size it is much smaller than any specimen from Canlaon, measuring only about 15 millimeters from snout to vent. The color above is gray, with an interorbital band, with a small transverse black spot on shoulders, and a larger irregular spot in the middle of the back; on the sides of the head and low on the sides of the body are numerous black spots or reticulations; the arm is light with strong bars across hand and digits; hind leg and foot lightly barred with darker; yellowish spots in groin. There is no evidence of vomerine teeth. The swelling on the tongue appears to be wanting; the tubercle on heel and the swelling on the tip of lower jaw are present. Although apparently a very immature specimen, I have no hesitancy in referring it to this species.

*Remarks.*—This species abounds on Canlaon Volcano. It appears to breed in the axils of a particular species of wild abacá, in which habitat all the specimens were found. The axils appear always to be filled with water; no tadpoles were taken, but some very young specimens were found. All were captured in December. The color markings appear to have no fixed pattern, great variation in color and markings being encountered. The yellow spots in the groin are usually present. The skin on the head and back is very shiny and smooth. The specimen described appears to be a full-grown female.

The characters which clearly distinguish this species from other Philippine species of this genus are the much shorter limbs; the small tympanum; the smooth, shiny skin; the supra-orbital tubercle and the tubercle on heel; the very small first finger. Many other, less obvious characters are evident on a comparison of descriptions. The variation in markings and colorations in this species leads me to regard markings in this group as of little value in determining species. The webbing of fingers and toes seems to place this species near to *Philautus woodi* Stejneger from Mount Apo, Mindanao.

Known from Negros and Panay.



**Philautus leitensis** (Boulenger.) Plate 1, fig. 3.

*Ixalus leitensis* BOULENGER, Ann. & Mag. Nat. Hist. VI 19 (1897)  
107.

*Description of species*.—(From No. B38, Bureau of Science collection; collected on Biliran Island, May, 1914, by R. C. McGregor.) Snout subacuminate, not projecting; head as broad as long; canthus rostralis distinct, loreal region somewhat concave, sloping rather than vertical; eye large, diameter of orbit minutely less than length of snout; tympanum partially outlined, covered with skin, very close to eye; nostril somewhat nearer tip of snout than eye; interorbital region distinctly wider than upper eyelid; a strong fold from eye to insertion of arm; skin finely shagreened above on head, back, and sides; belly strongly granular; granules large, mosaiclike; chin and throat smooth; fingers free, with large disks, first very small and slender, second shorter than fourth; a row of blunt tubercles on outer side of anterior part of arm; subarticular tubercles well developed; hind leg long; tibiotarsal articulation reaching slightly beyond tip of snout; toes about one-third webbed, third toe extending minutely farther than fifth; disks well developed; subarticular tubercles large; sole granular; a strong inner metatarsal tubercle; a row of indistinct tubercles along outer side of foot and heel; a rather prominent tubercle on end of tibia.

*Color in formalin*.—Above very light yellow-brown, with scattered dark brown spots, or groups of dots; a spot between eyes, one behind occipital region, one on either side of middle of back; a large spot in groin continuing on anterior part of thigh; posterior side of femur, tibia, and underside of tarsus brown; limbs dimly barred or spotted with brown above; belly immaculate cream.

*Measurements of Philautus leitensis* (Boulenger).

	mm.
Snout to vent	26
Length of head	11.5
Width of head	11.3
Length of snout, from eye	6
Depth of snout, in front of eye	3.8
Diameter of eye	5.2
Largest finger disk	2
Foreleg	18.5
Hind leg	45.
Femur	13.5
Tibia	15
Longest toe, from metatarsal tubercle	10

*Remarks.*—This specimen appears to be the second one known. The type was discovered in Leyte by John Whitehead and was presented to the British Museum.

*Philautus schmackeri* (Boettger.)

*Ixalus schmackeri* BOETTGER, Kat. Bat.-Samml. Mus. Senck. Nat. Ges. (1892).

*Description of species.*—Tongue pear-shaped, deeply notched behind, without papilla; head large, broader than back; snout sharply pointed, a little longer than diameter of eye; canthus angular, loreal region slightly depressed; nostril much nearer end of snout than eye; interorbital distance broader than an eyelid; tympanum distinct, about one-fourth the size of eye; fingers without web, first shorter and much slighter than second, third especially long and well developed; toes half webbed; toes with well-developed disks distinctly larger than tympanum; subarticular tubercles well developed; a slight inner metatarsal tubercle, tibiotarsal articulation reaching much beyond tip of snout; skin above smooth; below granulated; a light curved skin fold over eye to shoulder.

*Color.*—Above dark olive brown; a greenish white line from point of snout above nostrils, across edges of eyelids, over tympanum to side of body, there spreading as a large rhomboidal spot of lighter color; in middle of back the dark brown color of the back takes the shape of an hourglass; a large bright yellowish white spot on knee and elbow; legs above banded with darker brown; edges of lips dark brown with pure white spots; entire underside of body marbled with brown; neck brown, with light dots and a band across belly spotted and marbled with black.

*Measurements of Philautus schmackeri (Boettger).*

	mm.
Total length of body	18.5
Length of head	8.5
Width of head	8
Diameter of eye	3.25
Tympanum	.75
Foreleg	10
Hind leg	37
Femur	12.5
Tibia	13
Disk of fourth toe	1

*Remarks.*—The type specimen was collected on Mount Halcon, Mindoro. The name of the collector appears to be unknown.

The type was presented to the Senckenberg Museum by B. Schmacker, of Shanghai, in 1889. It is for him that the species was named. The species according to its author is characterized by the very long hind limbs and the very distinctive color and markings. The above description is taken from the type description.

*Philautus mindorensis* (Boulenger).

*Ixalus mindorensis* BOULENGER, Ann. & Mag. Nat. Hist. VI 19 (1897) 107.

*Description of species.*—(From Boulenger.) "Snout sub-acuminate, not projecting, as long as the diameter of the orbit; canthus rostralis distinct; loreal region concave; nostril slightly nearer the tip of the snout than the eye; interorbital space broader than the upper eyelid; tympanum distinct, one third to two fifths the diameter of the eye. Fingers free; toes one third webbed; disks as large as or a little smaller than the tympanum; a small inner metatarsal tubercle. Tibio-tarsal articulation reaching the nostril or the tip of the snout. Skin smooth above; throat and belly granulate."

*Color.*—"Grey above, sides paler, sometimes with a dark brown lumbar streak; temples, and sometimes the lores, dark brown; a white streak along the upper lip, or an oblique white streak below the eye; limbs with more or less distinct dark cross-bands; lower parts white, uniform or spotted or marbled with brown.

"From snout to vent 29 millim."

*Remarks.*—Several specimens from Mindoro (Mount Dulangan, 5,000 feet) are in the British Museum, collected by John Whitehead. I have seen no specimen of this species.

*Philautus longicrus* (Boulenger).

*Ixalus longicrus* BOULENGER, Ann. & Mag. Nat. Hist. VI 14 (1894) 88.

*Description of species.*—(From Boulenger.) "Snout pointed, as long as the diameter of the orbit; canthus rostralis angular; loreal region concave; nostril nearer the end of the snout than the eye; interorbital space broader than the upper eyelid; tympanum distinct, about two fifths the diameter of the eye. Fingers free, disks a little smaller than the tympanum; toes half-webbed. Tibio-tarsal articulation reaching far beyond the tip of the snout; femero-tibial articulation reaching the shoulder. Above rough with small warts; two oblique glandular ridges,



converging behind, between the shoulder[s]; throat smooth; belly and lower surface of thighs granulate."

*Color*.—"Grey above, with a large X-shaped dark marking or a pair of ) (-shaped bands on the back, a dark cross band or triangular blotch between the eyes, and regular cross bands on the limbs; a black light-edged spot on the knee; a streak below the canthus rostralis, a bar below the eye, and the whole temporal region blackish; dirty white beneath, throat finely speckled with brown; a series of small round white spots on the lower lip. Male with internal vocal sacs.

"From snout to vent 21 millim."

*Remarks*.—According to Boulenger the species is most closely related to *Philautus schmackeri* (Boettger). Three specimens were collected in Palawan by A. Everett.

I observed a specimen, which probably belonged to this species, in a mass of small plants just above a high waterfall in northern Palawan. I succeeded in getting the specimen but slipped while doing so. The ensuing fall liberated the specimen, which escaped by leaping over the waterfall.

*Philautus acutirostris* (Peters).

*Ixalus acutirostris* PETERS, Mon. Berl. Ak. (1867) 32; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 99; BOETTGER, Ber. Senck. Nat. Ges. (1886) 123; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 449.

*Description of species*.—(After Peters.) Snout pointed, canthus rostralis distinct; nostrils as far from each other as from end of snout; distance between nostrils contained in their distance from eye twice; tympanum very small, partly covered by skin; small granules upon the smooth skin of body as well as on eyelid; back part of the thigh and belly densely granulated; web on feet goes to the base of last joint on third and fifth toes.

*Color*.—Brown, and on the sides gray; small white dots present. Between the eyes an indistinct, brown, triangular spot, with a distinct spot near its posterior border; anterior and posterior side of thigh brown; below yellowish white.

*Measurements of Philautus acutirostris* (Peters).

	mm.
Total length	22
Foreleg	15
Hind leg	40

*Remarks*.—This species is known from two specimens, collected by Carl Semper in Mindanao.

*Philautus bimaculatus* (Peters).*Leptomantis bimaculatus* PETERS, Mon. Ber. Ak. (1867) 32.*Ixalus ? bimaculatus* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 106.

*Description of species.*—(After Peters.) Male with vocal sac, the openings small, not far from corner of mouth; tongue forked behind; snout scarcely longer than diameter of eye, with a distinct canthus rostralis, truncate in front; nostrils lateral, lying somewhat behind angle formed by the canthus rostralis and anterior end of snout; distance between nostrils is almost equal to their distance from eyes; tympanum small, the diameter about one-third diameter of eyes, and covered with skin; eyes very large, with pupil horizontal; body skin smooth; submental region with large granules; abdomen finely granulate; disks of fingers round, larger than toe disks; first finger placed opposite to the others, thickest at its base; second and third fingers one-third webbed; third and fourth half webbed; toes almost wholly webbed, reaching two-thirds of the distance on last joint of fourth toe; sole of foot smooth, a small projection covered with skin at its base; the insertion of sacral joint small.

*Color.*—Above violet-brown with unequal dark spots and transverse bands; a band between eyes; joints of limbs with darker transverse bands; under eye a characteristic, broadened, sharply truncate, yellowish white spot; a second, much smaller, immediately behind and under corner of mouth; below yellowish white.

*Measurements of Philautus bimaculatus* (Peters).

	mm.
Total length	34
Head length	12
Foreleg	25
Hind leg	62

*Remarks.*—Two specimens, the types, from the upper Agusan Valley, Mindanao, are known.

*Philautus montanus* sp. nov. Plate 3, fig. 5.

*Type.*—No. 29, Bureau of Science collection; collected on Mount Bongao, Bongao, near south end of Tawitawi, at an elevation of about 700 meters, by E. H. Taylor.

*Description of type.*—Vomerine teeth wanting; choanæ large, prominent, separated from inner eye prominences by a distance equal to one-half their diameter; tongue elongate with a large V-shaped notch, making two rather long horns behind; head longer than broad, bluntly pointed; canthus rostralis rather rounded; diameter of eye equal to distance of eye from nostril; nostril two and one-half times farther from eye than from end of snout; loreal region sloping obliquely, slightly concave; diameter of tympanum a little more than one-half diameter of eye, separated from eye by a distance equal to one-third its diameter; interorbital region one and one-half times width of an upper eyelid; skin smooth above, on head, back, and sides; chin smooth; posterior part of belly and thigh strongly granular; a slight supratemporal fold; arms short with a very narrow insertion; fingers broad, slightly webbed at base, with well-developed digital disks; disks equal to about two-thirds diameter of tympanum; first finger much shorter than second, its disk only slightly smaller than that of second; these two digits rather opposed to third and fourth; fourth finger reaches a little beyond base of disk of third; an indistinct skin fold on outer side of fourth digit, continued to elbow on outer side of arm; no inner web on arm; large nuptial excrescence on first finger; a well-defined kink at base of disks; toes two-thirds webbed, membranes reaching to base of toe disks only on outer side of second toe; fifth toe slightly longer than third, its disk reaching last subarticular tubercle on fourth toe; a very small, conical, inner metatarsal tubercle, about one-sixth the length of first toe; no outer tubercle; no fold on outer toe or along foot; subarticular tubercles well developed, not approaching disks in size; tibiotarsal articulation reaches tip of snout.

*Color in life.*—Above uniform, shiny, lavender-gray, with numerous very small, not clearly outlined, yellow spots; tip of snout darker than back; lores and upper lip gray, powdered with minute brown dots; a creamy yellow spot in front and somewhat below tympanum; latter light brown; irregular, distinct, dark spots from eye above arm and along sides, and areas of creamy yellow; belly dirty white to cream; chin with numerous small dusky spots; belly spotted; underside of limbs powdered with brown; anal region with a dark area, surrounded with a lighter yellow rim; arm and fingers with purplish brown bars; leg and foot barred with same color.



*Measurements of Philautus montanus sp. nov.*

	mm.
Length, snout to vent	39
Length of head	15
Width of head	13.9
Length of snout	7
Diameter of eye	5.9
Diameter of tympanum	3.2
Depth of snout, in front of eye	5
Diameter of finger disk	2.5
Foreleg	26
Hind leg	65
Longest finger	11
Femur	22
Tibia	22
Longest toe	15

*Remarks.*—Only a single specimen was taken. It was found in a small pool of water, near the top of Bongao Peak, on the small island of the same name. No other specimen was seen. This species appears to be most closely related to *Philautus vittiger* Boulenger, from Java, and the differences are not great when compared with Boulenger's description. *P. montanus* is probably a larger species, and the markings are entirely different.

## Genus CORNUFER Tschudi

*Cornufer* TSCHUDI, Class. Batr. (1838) 28; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 616; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 84; COPE, Nat. Hist. Rev. (1865) 115; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 107; Ann. & Mag. Nat. Hist. IX 1 (1918) 373.

*Hylodes* DUMÉRIL, Ann. Soc. Nat. 19 (1853) 177.

*Halophila* GIRARD, Proc. Acad. Nat. Sci. Philadelphia 6 (1853) 423.

*Platymantis* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 93; BOULENGER, Ann. & Mag. Nat. Hist. IX 1 (1918) 373.<sup>25</sup>

<sup>25</sup> Boulenger has recognized Günther's genus *Platymantis* as a genus distinct from *Cornufer* Tschudi. In the latter genus he includes for the most part large-disked forms. He includes the four Philippine forms *C. guentheri*, *C. jagori*, *C. worcesteri*, and *C. corrugatus*, the latter probably through error since he also includes this species with *Platymantis*, together with *P. meyeri*. I have been unable to examine a specimen of *C. jagori*, but it is described as having small but distinct disks, probably similar to those of *C. corrugatus*. The new species described in this work, *C. laticeps*, would also be referred to this group.

With my present study of the group I do not regard the separation of these groups as warranted, and doubt greatly that the character of the disks alone is more of a generic character than are vomerine teeth, the character of the nostril, or the webbing of the feet. The character of the disks appears to be the only difference between the two genera.

"Pupil horizontal. Tongue free and deeply notched behind. Vomerine teeth. Tympanum distinct. Fingers free; toes free or slightly webbed, the tips more or less dilated. Outer metatarsals united or separated by a groove. Omosternum and sternum with a bony style. Terminal phalanges T-shaped." (*Boulenger.*) Polynesia, western Malayan region, and the Philippines.

*Key to the Philippine species of Cornufer Tschudi.*

- a*<sup>1</sup>. Tips of fingers dilated into large disks.
  - b*<sup>1</sup>. Tongue with papilla; tibiotarsal articulation reaches nearly to tip of snout; with or without granules on belly.... *C. guentheri* Boulenger.
  - b*<sup>2</sup>. Tongue without papilla; tibiotarsal articulation reaches nostril; entire underside of body granular..... *C. worcesteri* Stejneger.
- a*<sup>2</sup>. Tips of fingers with small disks, smaller than or equal to toe disks; tibiotarsal articulation reaches beyond snout.
  - b*<sup>1</sup>. Tympanum two-thirds diameter of eye; first finger as long as second. *C. meyeri* (Günther).
  - b*<sup>2</sup>. Tympanum two-fifths diameter of eye; first finger shorter than second. *C. jagori* (Peters).
- a*<sup>3</sup>. Tips of fingers with small disks; tibiotarsal articulation not reaching tip of snout.
  - b*<sup>1</sup>. First finger longer than second; skin on back with distinct, regular, elongate, longitudinal folds; snout longer than eye. *C. corrugatus* (Duméril).
  - b*<sup>2</sup>. First finger longer than second; skin very rough with irregular folds; snout length equal to diameter of eye..... *C. laticeps* sp. nov.

*Cornufer guentheri* Boulenger. Plate 8, figs. 1 and 1a.

*Cornufer guentheri* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 108, pl. 11, fig. 3; BOETTGER, Ber. Senck. Nat. Ges. (1886); CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 450.

*Description of species.*—(From No. 550, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., May, 1913, by E. H. Taylor.) Vomerine teeth in two short oblique series



FIG. 3. *Cornufer guentheri* Boulenger. *a*, side of head; *b*, top of head; *c*, hand; *d*, foot.  $\times 2$ .

beginning on inner edge, but lying almost entirely behind posterior level of choanæ, separated from each other by a distance as great as, or greater than, the length of a single series; a distinct conical tubercle on anterior median part of tongue; head as long as broad or slightly longer; canthus rostralis distinct, slightly angular; loreal region sloping obliquely, somewhat concave behind nostril; diameter of eye slightly less than length of snout, reaching slightly beyond nostril; nostril one and one-third times farther from eye than tip of snout; tympanum small, circular, distinct, two-fifths to one-half diameter of eye, separated from eye by a distance equal to three-fourths its diameter; interorbital region less than the width of a single eyelid; eyelids bounded above by slight grooves; a slight, shallow, longitudinal groove on snout, continued to between nostrils; skin of back smooth; sides somewhat granular, or with short longitudinal folds; a large conical tubercle on posterior part of upper eyelid, with a few smaller indistinct tubercles; a very slight, distinct supratemporal fold; skin of belly and chin smooth; posterior aspect of thighs strongly granular; fingers free, slender, with large transversely widened disks, except disk on first, which is very small, scarcely wider than balance of digit; first finger very short, reaching about halfway between subarticular tubercle and disk of second finger; second finger very slightly shorter than fourth, neither reaching base of disk of third; diameter of largest finger disks greater than tympanum; subarticular tubercles large, rather flattened; toes slightly webbed at base, the membranes not reaching first subarticular tubercles; toes with small disks, very much smaller than finger disks; an elongate, oval, inner metatarsal tubercle, and a small, round, outer tubercle; third toe longer than fifth; tibiotarsal articulation reaches between eye and nostril.

*Measurements of Cornufer guentheri Boulenger.*

	mm.	mm.
Length, snout to vent	35	36.5
Length of head	15	15
Width of head	14.2	14.1
Length of snout	6.1	6.2
Diameter of eye	5.9	6
Diameter of tympanum	2.4	2.5
Diameter of finger disk	2.2	2.2
Foreleg	23	22
Longest finger	10	10
Hind leg	54	58
Longest toe	15	15.5
Tibia	17	18



*Variation.*—A second specimen, whose measurements are given in the second column, was taken in a nearby locality; it differs from the first in having a rather broad yellowish white line from point of snout to anus, balance of back cinnamon brown, snout and lores slightly granular. The dark spots on head are dim brownish; the tympanum is slightly larger, and the hind leg slightly longer, proportionally. They both differ from the type in having the entire under surface, except thigh, smooth instead of granular.

*Remarks.*—Both specimens are from Bunawan. They were found under loose bark, at the bases of large forest trees away from the immediate vicinity of water. No other specimen was observed. The type is from Dinagat Island and was collected by A. Everett. The specimen here described differs slightly from the type; in the type the tympanum equals half the diameter of the eye, and the tibiotarsal articulation reaches near to tip of snout. The skin above has granular folds in the type which are apparently absent in our specimen, save on the sides. The coloration and markings are obviously variable.

This species is similar to *Cornufer worcesteri* Stejneger, from which it differs in the following manner: Tongue without papilla; interorbital region somewhat wider, and entire underside of body granular. The last two characters are variable in many species; and, were it not for the absence of the papilla on tongue, I should be inclined to regard *C. worcesteri* as being identical with *C. guentheri*. Since the two species were founded on single specimens (Stejneger's in an admittedly indifferent state of preservation), larger collections may prove that they are the same species. My two specimens, which also differ somewhat from Boulenger's description as well as from each other, have distinct papillæ, but these are less distinct in No. 551 than in the described specimen.

*Cornufer worcesteri* Stejneger.

*Cornufer worcesteri* STEJNEGER, Proc. U. S. Nat. Mus. 28 (1905) 345.

*Description of type.*—(From Stejneger.) "Vomerine teeth in two oblique series behind the level of the hinder edge of the choanæ; orbital diameter slightly less than distance of orbit from tip of snout; interorbital space considerably wider than upper eyelid; canthus rostralis rounded; lores concave; crown flat; tympanum nearly circular, about one-half the diameter of the eye; fingers free, first considerably shorter than second, which is shorter than fourth; disks rather large; toes webbed at the base; disks well developed, though not quite so large as on

the fingers; hind limb being carried forward, the tibiotarsal joint does not reach the tip of the snout, only to about the nostrils; skin smooth above, (possibly with some longitudinal folds, but that cannot be decided on account of the state of the specimen) coarsely granular on the whole underside, including the throat; a distinct tubercle on the upper eyelid."

*Color*.—"Above pale brownish gray with small, irregular, dark brownish spots; snout decidedly brownish; a very distinct blackish brown band across the top of the head at the anterior end of the upper eyelids, involving them and continuing below the eye to the edge of the lip; tympanic region dark, but loreal region pale brown as the snout and without dark stripe; underside pale, finely dusted over with brownish; limbs with traces of dark cross bars."

*Measurements of Cornufer worcesteri Stejneger.*

	mm.
Total length	28
Width of head	12
Length of foreleg	17
Length of hind leg, from vent to tip of longest toe	45

*Remarks*.—The type specimen is in an indifferent state of preservation. According to Stejneger the species is most closely related to *Cornufer jagori* Peters, from Samar. The toe and finger disks are larger. The coloration seems to be distinctive, especially the frontal crossband.

*Cornufer meyeri* (Günther). Plate 8, fig. 3.

*Platymantis meyeri* GÜNTHER, Proc. Zool. Soc. London (1873) 171.

*Cornufer meyeri* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882)

109, pl. 11, fig. 4; BOETTGER, Ber. Senck. Nat. Ges. (1886) 124;

CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 450.

*Description of species*.—(From No. 69, Bureau of Science collection. Taken from the belly of a specimen of *Boiga dendrophila* from Luzon.) Vomerine teeth in two slightly oblique groups, lying almost wholly behind the posterior level of choanæ, the series rather short, somewhat rounded, separated from each other by a distance greater than the length of a single series; tongue broad, notched behind, with a large well-developed papilla on anterior median line; head much longer than wide; canthus rostralis only slightly angular; loreal region strongly concave; interorbital space slightly less than width of upper eyelid; diameter of eye a little less than length of snout; nostrils as far from each other as their distance from eye; nostril little more than one and one-half times as far from eye as from end of snout; diameter of tympanum from one-half to two-thirds of

eye; tympanum separated from eye by a distance greater than half its diameter; skin with short glandular folds, irregularly placed on body; a distinct supratemporal fold from eye to shoulder; limbs rather granular or with small folds; belly, chin, and underside of thighs perfectly smooth; posterior aspect of thighs and anal region granular; fingers long, slender, the first equal in length to the second; fourth extending slightly farther than first or second, all three reaching beyond first subarticular tubercle of third; disks small, slightly wider than digits; subarticular tubercles large, well developed, the middle one larger than the finger disks; carpal tubercles large, those on inner finger largest, those on middle finger second in size; no webs; no skin fold on

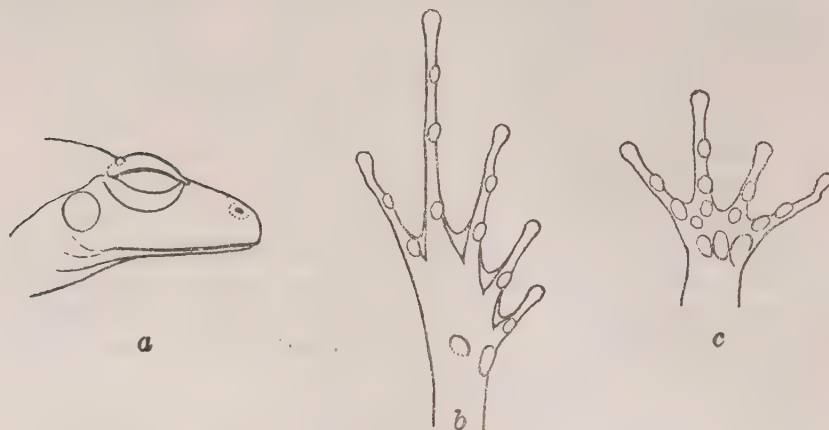


FIG. 4. *Cornufer meyeri* (Günther). a, side of head; b, foot; c, hand.  $\times 2$ .

outer side of fingers; toes long, slender, with a rudiment of web which does not reach beyond base of lower subarticular tubercles; disks distinctly wider than those on fingers; third toe longer than fifth; fifth reaching slightly beyond second subarticular tubercle of fourth toe; metatarsal tubercles strongly developed, but small; an outer round, and inner oval, tubercle less than one-third length of first toe; tibiotarsal articulation carried forward reaches beyond tip of snout.

*Color in alcohol.*—Above brownish slate, not uniform, with two distinct dorsolateral light lines from on eyelids to near end of body; upper part of arm whitish; subarticular tubercles of hands light; posterior part of thighs reddish brown; limbs bluish to grayish slate, femur with a few indistinct bars of darker color; tubercles of feet gray; belly dirty white, reticulated with dusky; indistinct spots on lips.



*Measurements of Cornufer meyeri* (Günther).

[The second measurements recorded are also from a Luzon specimen.]

	mm.	mm.
Length, snout to vent	41	38.4
Length of head	16.5	15
Width of head	14.5	14.5
Length of snout	7	6.5
Diameter of eye	6	5.9
Diameter of tympanum	3.5	3.5
Depth of snout, in front of eye	5	4.5
Foreleg	29	27.5
Longest finger	11.4	11
Hind leg	80	76
Tibia	24	23
Femur	19	19
Longest toe	23	22
Heel and foot	35.5	32.5
Diameter of toe disk	1.5	1.5

*Variation.*—There are many specimens of this species from Mindoro, Lubang, Luzon, and Negros in the collections studied. They agree fairly well in proportions, but the specimen here described is larger than any other in the collection. The specimens from Negros appear to have a deeper head and body than do those from Luzon and Mindoro. Practically no two specimens can be found with the same color patterns. Some are deeply reticulated with brown below, others uniformly light with no markings; some show a certain regularity in the arrangement of the longitudinal folds on the shoulders; a few from various localities have narrow median lines on the body, and others are marked with two lateral lines; others are uniformly colored above. Obviously, color markings are very unreliable characters in this group of frogs.

*Remarks.*—This species appears to be common in the localities named. The frogs are usually found moving about in the forest, away from the immediate vicinity of water. The type, collected by A. B. Meyer, is from "Laguna de Bay." Specimens are reported by Boettger from Mindoro and Leyte. Apparently it is strictly a Philippine species.

*Cornufer jagori* (Peters).

*Halophila Jagorii* PETERS, Mon. Berl. Ak. (1863) 456.

*Cornufer jagori* BOULENGER, Cat. Batr. Brit. Mus. ed. 2 (1882) 109;

BOETTGER, Ber. Senck. Nat. Ges. (1886) 124.

*Description of species.*—(From the type description.) Vomerine teeth in two oblique series, lying between and behind posterior level of choanæ; choanæ small; tongue heart-shaped, with

two points behind; diameter of eye almost equal to length of snout; tympanum roundish, about two-fifths diameter of eye; body with granules and distinct longitudinal folds; arm reaches back end of body; fingers entirely free, with small but distinct digital disks; first finger a little shorter than second and scarcely longer than fourth, third longest; two distinct longitudinal carpal tubercles; subarticular tubercles strongly defined; hind leg carried forward tibiotarsal articulation reaches beyond snout by one-third the length of tibia; disks of toes distinct; small web between base of toes; two metatarsal tubercles; subarticular tubercles of toes distinct; fifth toe shorter than third.

*Color*.—Body above dark brown; below whitish with dark brown, strongly defined on neck; lips and limbs with dark spots.

*Measurements of Cornufer jagori (Peters).*

	mm.
Total length	18.5
Length of head	8
Width of head	6
Foreleg	13
Length of hand, with third finger	5.5
Hind leg	35
Length of foot and fourth toe	16

*Remarks*.—I have been unable to obtain a specimen of this species. Peters does not mention the presence of a lingual papilla, and it probably does not occur. It would be well, however, to have the type examined to determine this point. It is probable that the type is immature; it is said to be not very well preserved. The type locality is "Insel Samar." The type was discovered by F. Jagor.

*Cornufer corrugatus* (Duméril). Plate 4, figs. 3, 3a, and 3b.

*Hylodes corrugatus* DUMÉRIL, Ann. Sci. Nat. III 19 (1853) 176.

*Platymanthis plicifera* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 95, pl. 8, fig. 3; Proc. Zool. Soc. London (1877) 132.

*Platymanthis corrugata* PETERS, Mon. Berl. Ak. (1873) 611; PETERS and DORIA, Ann. Mus. Civ. Gén. 13 420.

*Cornufer corrugatus* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 110; BOETTGER, Ber. Senck. Nat. Ges. (1886) 123; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 450; MÉHELY, Termes, Fuzetek 20 (1897) 411, pl. 10, fig. 142; BARBOUR, Mem. Mus. Comp. Zool. Harvard Coll. 44 (1912) 70; VAN DAMPEN, Nova Guinea 5 (1906) 167.

*Description of species*.—(From No. 200, E. H. Taylor collection; collected on Mount Maquiling, near Los Baños, Laguna, P. I., May, 1916, by E. H. Taylor.) Vomerine teeth in two short, oblique groups, somewhat rounded, lying for the most part behind

the level of the choanæ; tongue large, oval, not deeply notched behind, the horns rather widely separated at base; a distinct enlarged papilla on tongue; choanæ rather large; head pointed, as wide as long or a little wider, canthus rostralis present, slightly rounded, the edges converging to tip of snout, where they just fail to make an angle; eyes prominent, their diameter less than length of snout, but reaching beyond nostril; distance of nostrils from each other equals their distance from eye; nostrils one and a half times as far from eye as from end of snout; neither snout nor forehead concave; lores sloping gently, not or scarcely concave; interorbital area equal to, or a little less than, a single eyelid; anterior outline of head unbroken by eye, when viewed from above; tympanum equals about two-thirds eye, its outline rather indistinct on upper posterior part; skin of head



FIG. 5. *Cornufer corrugatus*<sup>85</sup> (Dunéril). a, side of head; b, foot; c, hand.  $\times 2$ .

smooth, granular above eyes; skin on back arranged in rather regular, elongate, symmetrical folds, with shorter folds and scattered tubercles; sides granular; rather prominent tubercles behind and below tympanum; upper part of limbs with more or less distinct rows of granules; belly and posterior aspect of thighs strongly granular; chin and underside of foot dimly granular; a strong supratemporal fold to arm; fingers short, first longer than second and fourth but a little shorter than third, second and fourth subequal; disks very small, smaller than the largest subarticular tubercles; subarticular tubercles on palm large, distinct; digits quite free; toes slender, with a rudiment of web; digits small, about equal to subarticular tubercles; an oval inner metatarsal tubercle and a conical outer tubercle; point of tibiotarsal articulation granular; when brought forward it reaches between eye and nostril, but nearer the latter; male with two internal vocal sacs.



*Color in life.*—Above reddish brown, with darker regular spots in middle of back; a dark interorbital spot covering part of eyelids; snout light yellow-brown, lighter on canthus; below canthus dark, growing slightly lighter on lip; tympanum brown, with a black area covering upper part, and an area behind, below supratympanic fold, arms and legs barred with brown, with a few distinct black spots on thigh near knee and just above heel; a dark stripe on tarsus and sole strongly contrasted with the lighter color above foot; below cream, posterior aspect of thighs brownish; darker about anus.

*Measurements of Cornufer corrugatus (Duméril).*

	mm.
Length, snout to vent	41
Length of head	19
Width of head	19
Diameter of eye	5.5
Diameter of tympanum	3.5
Length of snout	7.3
Depth of head, in front of eye	5
Foreleg	26.5
Longest finger	11
Hind leg	76
Tibia	24.5
Femur	22
Longest toe	21
Diameter of disk	1

*Variation.*—This species, which appears to be distributed over the entire eastern part of the Philippine Archipelago, exhibits considerable variation. The characters that appear invariable are that the first finger is longer than the second, and the tibio-tarsal articulation fails to reach tip of snout. The longitudinal folds on the back are usually regular, assuming the same general outlines. However, there are two specimens from Los Baños, Laguna, Luzon, which approach *Cornufer meyeri* (from the same locality) in coloration; the arrangement of the lines on the back differs from the typical *C. corrugatus* in that they are short and, apparently, do not conform to any regular pattern; the lips, both upper and lower, are strongly spotted with black; the lores are black and there is a distinct temporal black spot limited by the supratemporal fold; the spots on the inner sides of limbs are very distinct; there are distinct spots of black on shoulders; a dark stripe is present on heel and foot. Another small specimen from the same locality is identical with the above in color and markings.

Some specimens from Negros and Mindanao, when first taken, were almost uniform flesh pink on the back, with bright carmine spots on the posterior part of thighs and tibia and on the anterior part of femur and about groin. The Mindanao specimens were darkest, and those in the collection from Negros, lightest. There are specimens in my collection from Luzon, Mindanao, and Negros. Boettger reports the species from Tablas. Outside the Philippines, it is known in Ceram, New Guinea, the Kei Islands, the Bismarck Islands, and Halmaheira. I believe it has not been taken in Borneo.

*Cornufer laticeps* sp. nov. Plate 3, fig. 1.

*Type*.—No. 197, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, September, 1912, by E. H. Taylor.

*Description of type*.—Vomerine teeth in two short, somewhat rounded series, lying for the most part behind hinder level of choanæ, but arising from their inner posterior edge; tongue nearly as wide as long, with two small, rounded, posterior horns, separated at base; a large papilla on anterior median part; head a little longer than broad; canthus rostralis rounded; lores sloping slightly at top, then very obliquely over lip to mouth, concave behind nostril; eye large, its diameter as long as snout or slightly shorter; nostril twice as far from eye as from end of snout; width of interorbital region equal to about one-half width of a single eyelid; tympanum small, its posterior border not distinct, vertically oval, little more than one-third diameter of eye; skin rough, granular, and tubercular; prominent tubercles on lores, snout, eyelids, sides, and back; a few short longitudinal skin folds on dorsolateral region; a strong supratemporal fold partially covering tympanum; skin of chin smooth; belly smooth except on posterior part, which is granular; underside of thighs smooth, posterior aspect granular; first finger longer than second and equal to fourth; no trace of webs; disks scarcely wider than digits, not larger than subarticular tubercles; no humeral fold or skin fold on outer side of fourth finger; toes with mere rudiment of web; disks on toes larger than those on fingers; subarticular tubercles prominent, conical; third toe extends farther than fifth; fourth very long; a longitudinally oval, inner metatarsal tubercle, and a rounded outer which is smaller; no tarsal fold; no skin fold on outer side of toes; greatest width of body immediately posterior to tympanum; entire outline of head not broken by eye when viewed from above; tibiotarsal articulation reaching to near nostril.

*Color in life.*—Above brown, mottled and spotted with darker brown; somewhat lighter longitudinal areas on either side of back, and another between eyes followed by a darker area; snout darker; lips barred with lighter and darker bars; a dark brown temporal area; sides lighter than back, spotted with brown; foreleg strongly barred with brown; third and fourth fingers barred with brown; hind legs cinnamon brown with darker bars; toes barred with darker and lighter brown; belly creamy white; chin dusky.

*Measurements of Cornufer laticeps sp. nov. Type and two cotypes.*

	Type.	Cotype.	Cotype.
	mm.	mm.	mm.
Length, snout to vent .....	49	40	40
Length of head .....	22	17.5	17.5
Width of head .....	20.2	17.5	17.5
Width of upper eyelid .....	6.5	5.5	5.2
Diameter of eye .....	7.5	6	6.2
Length of snout .....	7.9	6.8	7.5
Diameter of tympanum .....	3	3	3.2
Foreleg .....	29	24	24
Longest finger .....	12.2	10.3	10
Hind leg .....	81	71	70.5
Femur .....	25	21	21.5
Tibia .....	27	23	22
Longest toe .....	25.5	20.5	21

*Variation.*—The listed measurements record the chief proportional differences which occur in three specimens. Three other specimens in the collection are of the same size as the two smaller specimens whose measurements are given. In color and markings they vary but little.

This species is related to *Cornufer jagori* (Peters), from Samar, and possibly also to *C. vitianus* Duméril, of the Fiji Islands. From *Cornufer jagori* it appears to differ in having shorter hind legs, the tibiotarsal articulation reaching about to nostril instead of beyond snout, the first finger being distinctly longer than second, the lingual papilla being present, in being much larger in size, and in having greater ruggedness of skin and width of head.

Specimens were collected in the immediate vicinity of water, at low elevations, usually under leaves or logs along the edges of small mountain streams. Many other specimens taken were lost in shipment. Not rare at Bunawan.



## ENGYSTOMIDÆ

No maxillary teeth; diapophyses of sacral vertebræ dilated; sternal structure variable. Distal phalanges simple or T-shaped; pupil erect or horizontal. Vertebræ procœlian, without ribs. This family shows very marked variation in numerous skeletal characters; especially in the sternum, and in the articulation of the coccyx. In the Philippines five genera have been recognized, containing in all eight species.

*Key to the Philippine genera of Engystomidæ.*

- a*<sup>1</sup>. Pupil erect; no precoracoids; tympanum hidden.
  - b*<sup>1</sup>. Tongue elliptic; a cutaneous ridge across palate between choanæ and another in front of œsophagus; fingers free, toes more or less webbed ..... *Microhyla* Tschudi.
  - b*<sup>2</sup>. Tongue oblong; palatine bones forming a bony ridge (sometimes toothed) across palate; two cutaneous ridges across palate in front of œsophagus..... *Kaloula* Gray.
- a*<sup>2</sup>. Pupil horizontal; precoracoids present; no vomerine teeth.
  - b*<sup>1</sup>. Tongue oval; a dermal ridge across palate, between and in front of Eustachian tubes; fingers free, toes partly webbed; tympanum distinct ..... *Kalophrynus* Tschudi.
  - b*<sup>2</sup>. Tongue elliptical; a very indistinct bony ridge may be present behind choanæ; dermal fold in front of œsophagus; tympanum sometimes wanting; fingers and toes entirely free..... *Chaperina* Mocquard.
  - b*<sup>3</sup>. Tongue large, rounded, a doubly arched palatal ridge present or absent; a smooth dermal ridge in front of Eustachian tubes, and another behind them; tympanum present; fingers and toes free; no subarticular tubercles..... *Phrynixalus* Boettger.

For the most part these small toads are terrestrial and burrowing, although one species, *Kaloula conjuncta*, ascends trees and probably makes them a more or less permanent habitat. Several of the species live exclusively on ants. Many of the species exude from their skin a poisonous substance which protects them from being eaten by their enemies.

Several specimens of *Kaloula picta* were placed in a cobra cage, and four of them were eaten by a young female cobra. After finishing the meal she rubbed her head about the cage, seemed extremely restless, frothed at the mouth, and appeared to be in pain. Later two other frogs were seized, partially swallowed and then ejected. When other food, such as a medium-sized *Rana*, was available, the *Kaloula* were not touched by the cobras. A dog will sometimes pick up one of these small toads in his mouth, but immediately eject it in great disgust.

The male *Kaloula conjuncta*, when clasping the female, becomes glued to her back by excretion, either from her back or from his belly. This fact was noted also in *Kalophrynus stellatus*.

Genus MICROHYLA Tschudi <sup>26</sup>

*Microhyla* TSCHUDI, Class. Batr. (1838) 71; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 163; Fauna Brit. India, Rept. (1890) 491.

*Microhyla* DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 613; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 121.

*Hylaplesia* FITZINGER, Syst. Rept. (1843) 31.

*Siphneus* FITZINGER, Syst. Rept. (1843) 33.

*Dendromanes* GISTEL, Naturg. Thierr. (1848) 11.

*Diplopelma* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 50.

*Scaptophryne* FITZINGER, Sitz. Ber. Ak. Wien 42 (1861) 146.

Pupil vertical; tongue elliptical, entire, free behind; a more or less distinct cutaneous ridge across palate between choanæ, and another in front of œsophagus; tympanum hidden; fingers free; toes more or less webbed, sometimes very slightly; tips of fingers and toes blunt or more or less dilated; outer metatarsals united; no precoracoids; no omosternum; sternum cartilaginous; diapophyses of sacral vertebræ moderately dilated; terminal phalanges simple. India, China, Japan, and East Indies.

*Remarks.*—One species has been reported from the Philippines, on the doubtful authority of J. G. Fischer.<sup>27</sup> I have included the species because of the possibility of its occurrence. It is noteworthy that the genus *Microhyla* is the only representative of the Engystomidæ found in Formosa and the islands to the north.<sup>28</sup> One species is confined to Formosa; a second inhabits the islands between Formosa and Japan proper.

*Myrohyla achatina* (Boie).

*Hylaplesia achatina* BOIE, Isis (1827) 294.

*Microhyla achatina* TSCHUDI, Class. Batr. (1838) 71; PETERS and DORIA, Ann. Mus. Genov. 13 428; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 166; BOETTGER, Ber. Senck. Nat. Ges. (1886) 124; FISCHER, Jahrb. Wiss. Anst. Hamburg 2 (1885) 80; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 450; BARBOUR, Mem. Mus. Comp. Zool. Harvard Coll. 44 (1912) 71, pl. 7, fig. 27.

*Microhyla achatina* DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 614; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 121.

<sup>26</sup> Of doubtful occurrence in the Philippine Islands.

<sup>27</sup> Jahrb. Wiss. Anst. Hamburg 2 (1885) 80.

<sup>28</sup> In a recent letter M. Lazo, who is making a herpetological collection in the Batan Islands for the Bureau of Science, says that no batrachians of any sort are to be found there. This statement may be questioned and is remarkable if true. The Batan Islands lie between Formosa and Luzon.

*Description of species.*—(From Boulenger.) "Habit slender. Snout subacuminate, longer than the orbital diameter; inter-orbital space broader than the upper eyelid. Fingers rather slender, first much shorter than second; toes slender, webbed at the base; tips of fingers swollen into very small, of toes into well-developed disks; subarticular tubercles distinct; two small metatarsal tubercles. The hind limb being carried forwards along the body, the tibio-tarsal articulation reaches the tip of the snout, or beyond. Skin smooth."

*Color.*—"Brown above; sides and a streak between the eyes dark brown; sometimes the back with rather indistinct chevron-shaped darker and lighter lines and a narrow light vertebral line; limbs more or less distinctly cross-barred; anal region blackish."

*Remarks.*—This species is included here on the strength of Fischer's report, but not without some doubt. His specimen was presumably from southern Mindanao. The species is known from the Malay Peninsula, Sumatra, Nias, and Java. Barbour's specimen from Java was taken at an altitude of about 1,520 meters. The fact that no more specimens have been found in the Philippines may be due to the paucity of collections from high mountains.

#### Genus *KALOULA* Gray

*Kaloula* GRAY, Zool. Misc. (1831) 38; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 122.

*Hylaedactylus* TSCHUDI, Class. Batr. (1838) 85; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 732.

*Plectropus* DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 736.

*Holonectes* PETERS, Mon. Berl. Ak. (1863) 455.

*Calohyla* PETERS, Mon. Berl. Ak. (1863) 455.

*Callula* GÜNTHER, Rept. Brit. India (1864) 436; COPE, Journ. Acad. Nat. Sci. Philadelphia II 6 (1867) 192; BOULENGER, Cat. Batr. Sal.

Brit. Mus. ed. 2 (1882) 167; Fauna Brit. India, Rept. (1890) 493.

"Pupil erect. Tongue oblong, entire and free behind. Vomerine teeth none; palatine bone forming an acute, sometimes toothed ridge across the palate. Two cutaneous, more or less distinctly denticulated ridges across the palate, in front of the œsophagus. Tympanum hidden. Fingers free; toes more or less webbed, exceptionally free, the tips more or less dilated. Outer metatarsals united. No precoracoids; no omosternum; sternum cartilaginous. Diapophyses of sacral vertebra moderately dilated. Terminal phalanges triangular or T-shaped. East Indies." (*Boulenger.*)



Key to the Philippine species of *Kaloula* Gray.

- a*<sup>1</sup>. Toes slightly webbed at base; digits dilated, especially fingers; a blunt inner metatarsal tubercle..... *K. baleata* (Müller).  
*a*<sup>2</sup>. Toes one-third webbed, or more.  
     *b*<sup>1</sup>. Tips of fingers very small; inner metatarsal tubercle very large, compressed ..... *K. picta* (Bibron).  
     *b*<sup>2</sup>. Tips of fingers with very large disks; inner metatarsal tubercle moderately large..... *K. conjuncta* (Peters).

*Kaloula picta* (Bibron). Plate 9, fig. 4.

*Plectropus pictus* BIBRON, in Eydoux and Souleyet, Voy. Bonite, Rept. pl. 9, fig. 2; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 737; STEINDACHNER, Verh. Zool. Bot. Ges. Wien 14 (1864) 257.

*Kaloula picta* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 123, part.

*Callula picta* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 168; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1896) 451.

*Description of species.*—(Described from sixteen males and seventeen females; collected July 11, 1917, in a small pool near an electric light on a street of Manila, by E. H. Taylor.) Palatal



FIG. 6. *Kaloula picta* (Bibron). *a*, side of head; *b*, foot; *c*, hand.  $\times 2$ .

bones forming two transverse ridges across ridge of mouth immediately behind choanæ, curved backward on inner ends; snout very short and obtusely rounded, canthus rostralis rounded and not prominent; loreal region sloping very obliquely, not or very slightly concave; eye large, the supraocular region prominent; diameter of eye equals distance from eye to apex of snout; distance between nostrils greater than their distance from eye; nostrils halfway between eye and tip of snout; skin of back smooth or granular; granules when present scattered, or sometimes in indistinct longitudinal rows; a minute median dorsal fold sometimes present; granules numerous on posterior aspect of thigh; skin of belly slightly wrinkled, sometimes granular posteriorly; tympanum not or scarcely visible; a distinct fold

from corner of eye to in front of foreleg; legs strong, hind legs (tip of toe to anus) longer than distance from snout to anus; fingers free, first much shorter than second, latter nearly same length as fourth; tips of fingers and toes not dilated into disks; subarticular tubercles well developed; toes about one-third webbed, very large; an inner metatarsal tubercle longer than first toe, outer metatarsal tubercle much smaller, prominent, their edges rather sharp and hard; tarsus without fold; males with simple vocal sac which opens by a pair of slits on side of tongue; underside of chin of males with two or three large folds of skin; a slight fold frequently evident across head behind eyes; tongue free and entire behind; pupil vertical; the tibio-tarsal articulation reaches eye.

*Color in life.*—The specimens vary in color from a dull muddy drab to dull red, through varying shades of olive and olive brown. Back with a large irregular blotch of darker color, frequently resembling the silhouette of a man standing upright with two horns on his head; dark laterally, becoming lighter on belly; belly rather light, covered with brownish reticulations, numerous on chin; legs and arms barred with darker; in the breeding males the throat is a dark yellow green, and a wash of greenish color on forelegs is sometimes present; in alcohol the green on throat becomes slate colored.

*Measurements of Kaloula picta (Bibron).*

	mm.
Length, snout to vent	43
Length of head	12
Width of head	13.5
Diameter of eye	4.6
Length of snout	4.6
Width of body, greatest	25
Foreleg	26.5
Longest finger	12
Hind leg	56
Tibia	15
Longest toe	19

*Variation.*—The males and females before me may be easily distinguished by the green color on chin of the former. The females are larger and for the most part are heavy with eggs. The skin on chin and throat of the males is stretched and is plicate, or with a single large fold, due to the expansion of the vocal sacs during the breeding season.

*Remarks.*—There can be no doubt as to the distinctness of the two species, *Kaloula picta* and *K. conjuncta*. None of the specimens at hand, male or female, of the former species has the

ends of the digits dilated. During the breeding season these frogs are incredibly common about Manila, even on the streets; they may be taken in quantity at this time, after which they disappear and are very rarely found. They seem to be wholly terrestrial or subterrestrial. The species is known in Luzon, Negros, and Mindoro. Three specimens in my collection, presented to me by W. Schultze, are said to be from Dumaran Island, near Palawan. This locality I believe doubtful.

*Kaloula baleata* (Müller).

*Bombinator baleatus* MÜLLER, Verhandel. Batav. Genootsch. (1836) 96.

*Hylaedactylus baleatus* TSCHUDI, Class. Batr. (1838) 85; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 734.

*Kaloula baleata* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 122; STEINDACHNER, Novara, Amph., 68; BARBOUR, Mem. Mus. Comp. Zool. Harvard Coll. 44 (1912) 72.

*Callula baleata* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 169; BOETTGER, Ber. Senck. Nat. Ges. (1886) 124; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 451.

*Description of species.*—(From Boulenger.) "Snout short, rounded, as long as the orbital diameter; interorbital space broader than the upper eyelid. Fingers moderate, the tips strongly dilated, truncated; first finger shorter than second; toes

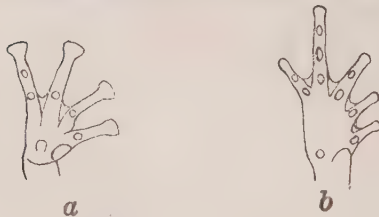


FIG. 7. *Kaloula baleata* (Müller). After Boulenger. a, hand; b, foot.

rather short, webbed at the base, the tips swollen into small disks; subarticular tubercles distinct; metatarsal tubercles two, oval, inner large, compressed, with blunt edge. The hind limb being carried forwards along the body, the tarso-metatarsal articulation reaches between the

shoulder and the eye. Skin smooth, or with small flat warts on the upper surfaces; a fold from the eye to the shoulder, and another, more or less indistinct, across the head behind the eyes. Male with a subgular vocal sac."

*Color.*—"Brown, olive, or blackish above, uniform or variegated with darker; frequently large whitish spots on the armpits, on the loins, and on the limbs; beneath brown, variegated with whitish."

*Remarks.*—This species is known from Java, Celebes, and the Philippine Islands. Two specimens in the British Museum were collected by Dr. A. B. Meyer, at Laguna de Bay. It is noted that Meyer also collected this species in Celebes and that specimens from that locality also are in the British Museum. As the



species has not been rediscovered in the Philippines, I rather suspect that a change of labels has occurred, and that the so-called Philippine specimens are in reality from Celebes.

*Kaloula conjuncta* (Peters). Plate 9, fig. 1.

*Hylaedactylus (Holonectes) conjunctus* PETERS, Mon. Berl. Ak. (1863) 455.

*Kaloula picta* (B. female) GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 123, part.

*Hylaedactylus conjunctus* STEINDACHNER, Vehr. Zool. Bot. Ges. Wien 14 (1864) 256, pl. 11, fig. 5.

*Callula conjuncta* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 168; MÜLLER, III Nacht. Cat. Herp. Samml. Basel. Mus. (1883) 4; COPE, Journ. Acad. Nat. Sci. Philadelphia II 6 (1867) 192; BOETTGER, Ber. Senck. Nat. Ges. (1886) 124; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 451.



FIG. 8. *Kaloula conjuncta* (Peters). a, side of head; b, foot; c, hand.  $\times 1$ .

*Description of species.*—(From No. 798, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., July 10, 1912, by E. H. Taylor.) No vomerine teeth; choanæ large, transversely elongate, distance between them only a little more than half distance between nostrils; beginning on posterior outer edges of choanæ are denticulated dermal ridges, which barely fail to meet medially; they border the choanæ behind; in the posterior palate are two dermal ridges in front of œsophagus, the posterior nearly straight, the anterior rather arched; tongue elongate, oval, not notched behind, free behind; male with internal vocal sac; head short, much wider than long; diameter of eye equal to its distance from tip to snout; snout truncate; nostrils rather widely separated, distance between them greater than their distance from eye; canthus rostralis rounded, lores slightly sloping; interorbital distance equal to one and one-third times the width of upper eyelid; pupil horizontal; tympanum almost entirely hidden; skin of body above smooth, as well as on limbs and underside of body, except about anal region and posterior part of thighs; a few indistinct smooth granules follow the dorsolateral line; a smooth fold from eye

to insertion of arm; fingers entirely free, tips distended into large disks at least two-thirds diameter of eye; first finger much shorter than second, which in turn is somewhat longer than fourth, with a slightly larger disk; second finger fails to reach disk of third; subarticular tubercles well developed; an indistinct tubercle on base of first finger, and a large flat tubercle on palm; legs moderate, toes about one-half webbed, provided with disks smaller than those on fingers; third toe, which is much longer than fifth, reaches first subarticular tubercle of fourth; subarticular tubercles of toes rather dim; a blunt, rather indistinct inner metatarsal tubercle; a small dim outer tubercle; skin of body joins femur about halfway from end; a slight fold on heel; hind leg brought forward the tibiotarsal articulation fails to reach angle of jaw.

*Color in life.*—Above grayish brown, not uniform; back with a large, rather regular spot, two branches of which touch the eyelids; it forks near the middle of back, each branch going to groin, and continues across the limb when folded; two irregular spots on either side of rump; loreal region rather darker; a dark, irregular, broken line from eye to groin, below which the color is slightly darker brown than on back; a dark spot on insertion of arm, one on elbow and one across wrist; a transverse light spot at upper base of digits; a dark spot on foot; posterior part of thigh dark; the dark color arching to include anus; below dull dusky brown, with darker brown marblings, spots, and reticulations.

*Measurements of Kaloula conjuncta (Peters).*

	mm.
Length, snout to vent	47.5
Length of head	14
Width of head	17
Interorbital width	6.1
Length of snout	6
Diameter of eye	6
Depth of head, in front of eye	6
Foreleg	37
Longest finger	16
Diameter of disk on third toe	4
Hind leg	72
Femur	22
Tibia	20
Foot	31
Longest toe	21
Largest toe disk	2.5

*Variation.*—No. 28, Bureau of Science collection, exhibits a remarkable variation; the skin of the back is puffed out so as

to form a huge sac, as has been recorded by Günther in *Cacopus globosus* of India.<sup>29</sup> In this specimen, a female, it would appear that the large dorsal skin sac was filled with air or fluid in life. It agrees in practically all characters with the specimen described; the color pattern is very dim; the dermal folds on palate are identical in arrangement; the denticulation on anterior folds is more evident. The specimen is a very large one, by far the largest example in the collection. Length, snout to vent, 68 millimeters; foreleg, 56; hind leg, 96. The locality is Manila.<sup>30</sup>

I have sixteen females and eight males from Mindanao. A much larger series was collected, but the specimens were lost. The male differs from the female in that the former has a vocal sac, the chin is black, and the skin is somewhat distended and sometimes in folds; the toes are at least two-thirds webbed, the membrane frequently reaching the outer base of digits on first, second, and third toes, and the inner base of fifth. At first I believed I was dealing with distinct species, but when I found them breeding it was obvious that they were males and females.

A specimen collected by myself in Bubuan Island (Tapiantana Group), Sulu, is much darker, and the typical markings on the back are very distinct; there is a hair line from snout to vent along the middle of back.

One specimen, No. 790 E. H. Taylor collection, exhibits a series of small, light, dark-edged spots on the back and, especially, on the sides; the specimen is somewhat dried, but the webbing of the toes seems a little less than in normal specimens. The marking on the back is very indistinct. The specimen is from Guimaras Island. A Negros specimen has the upper surface covered with rough tubercles, and the posterior part of the belly granular.

*Remarks.*—This species was described from a Luzon specimen, but I have been unable to find it in that island. In Mindanao, however, it is extremely common at certain seasons. It is known to the Manobos as *coquat*. At Bunawan, Agusan, the breeding season for this frog began November 28, 1912, after a storm with heavy rainfall. From the time of my arrival in June to that date I had not observed a single specimen. During the night of the 27th, a large depressed area in the swamp near the house filled with water, and thousands of these toads collected from all

<sup>29</sup> Rept. Brit. India (1864) 416.

<sup>30</sup> The specimen was collected by Mrs. Graham, who presented it to the Bureau of Science together with certain Philippine snakes (*Dryophiops philippina*). I believe there is no doubt as to the locality, although I have been unable to verify it.



parts of the forest. Their croaking made an ominous roar, easily heard a kilometer away. The note is *chuck-chuck-chuck* rapidly repeated. Males seem to occur in larger numbers than females; not infrequently females were observed mounted by four or five males. The male exudes a sticky substance on the belly which fastens him to the female. Occasional specimens were found mounted by males of *Kalophrynus stellatus* that were breeding at the same time. While the eggs were being deposited, the frogs swam about on the surface of the water.

The species is arboreal and burrowing. When a small *Pandanus* tree, about 7 meters high was cut, twelve specimens were taken from the axils of the leaves. Others were unearthed by my collectors from about peanut and *camote* vines. They appear to feed largely, if not wholly, on ants. The type is from Luzon.

#### Genus KALOPHRYNUS Tschudi

- Kalophrynus* TSCHUDI, Class. Batr. (1838) 36; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 54; COPE, Journ. Acad. Nat. Sci. Philadelphia II 6 (1867) 195; STEJNEGER, Proc. U. S. Nat. Mus. 33 (1908) 575. *Berdmorea* STOLICZKA, Proc. As. Soc. Bengal (1872) 146. *Calophrynus* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 157.

No teeth in jaws; no vomerine teeth; a dermal ridge across palate between or behind choanæ; one or two dermal denticulated ridges between, and in front of, Eustachian tubes; head small; mouth small; tongue oval, free or notched behind; tympanum distinct; skin of back thick and glandular like a parotoid; pupil horizontal; fingers free, toes partially webbed, digits without disks; outer metatarsals united, coracoids broad, abutting; pre-coracoids weak, parallel with latter; omosternum and sternum cartilaginous; diapophyses of sacral vertebræ moderately dilated; terminal phalanges simple.

The genus is known from southern China, Borneo, and the Philippines. Two species have been described from the Philippines; one from Mindanao, the other from either Culion or Samar.

#### Key to the Philippine species of *Kalophrynus* Tschudi.

- $\alpha^1$ . Snout pointed; tongue nearly circular; tibiotarsal articulation reaches tympanum; tympanum four-fifths eye; no sacral spots. *K. acutirostris* (Boettger).  
 $\alpha^2$ . Snout pointed or blunt; tongue oval; tibiotarsal articulation reaches eye; tympanum about three-fourths eye; two black, white-edged sacral spots ..... *K. stellatus* Stejneger.

These small toads are terrestrial. When taken in the hand alive they exude a white viscous fluid from the entire surface

of the back, which sticks to the hand with great tenacity and takes much effort to remove.

*Kalophrynus stellatus* Stejneger. Plate 9, fig. 2.

*Kalophrynus stellatus* STEJNEGER, Proc. U. S. Nat. Mus. 33 (1908) 575.

*Description of species.*—(From No. 216, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., June, 1912, by E. H. Taylor.) Tongue roundly oval, not notched behind; no vomerine teeth; a strong, smooth, distinct dermal ridge running across palate just posterior to choanæ, forming a slight angle medially and not separated medially; choanæ concealed under overhanging jaw; a strongly denticulated dermal ridge running straight across palate in front of œsophagus between the Eustachian tubes; a second arched dermal ridge in front of this, much shorter, the space between triangular; head triangular, slightly wider than long; canthus rostralis roundly angular; loreal region nearly vertical; snout pointed; nostril nearer tip of snout than eye; distance between nostrils greater than their distance from eye; eye large, prominent, its diameter equal to its distance from snout; tympanum large, distinct, very close to eye, its diameter about three-fourths of diameter of eye; interorbital space one and one-half times the width of a single eyelid; skin of back very thick, glandular, covered with small granules; a few larger granules on eyelid; chin and breast rather smooth; belly and underpart of thighs very strongly granular, the granules large and fairly uniform; a distinct supratympanic fold, which limits the thick padded skin of occiput; no dorso-lateral fold; fingers short, first and fourth equal, neither extending as far as third; second reaching first subarticular tubercle of third; tips slightly swollen; subarticular tubercles strong, somewhat keeled; toes short; third, distinctly longer than fifth, does not reach farther than second subarticular tubercle of fourth; a well-defined inner metatarsal tubercle, about two-thirds the length of first toe; outer tubercle very indistinct; toes about one-third webbed, the membrane reaching halfway up on digits, on the outer side of first three digits, and on inner side of fifth; fails considerably to reach second tubercle on fourth.

*Color in life.*—Above pinkish gray, mottled and marked with somewhat darker color; an irregular darker stripe runs from right eyelid to left groin, and another from left eye to right groin, crossing on shoulders. At end of each stripe is a distinct, round, light-edged black spot; balance of area mottled with irregular, lighter-edged markings; a distinct dark stripe across femur

and another across tibia, which form continuations of the two dorsal stripes when limbs are folded; a dark spot on outer side of foot, on elbow and wrist; fingers barred with dark and light bars; side of head and body dark black-brown, bordered above by a continuous lighter line, which limits the dorsal color; chin carmine to red-brown; posterior part of body reddish yellow; a few scattered bright yellow-orange spots on breast and belly; heel and underside of wrist dark. In the anal region there is a transverse lighter line, which limits the upper body color; below this line darker on posterior part of thighs.

*Measurements of Kalophrynus stellatus Stejneger.*

	mm.
Length, snout to vent	45
Length of head	14.5
Length of snout	5.5
Width of head	16
Diameter of eye	5.5
Diameter of tympanum	4
Interorbital width	5.8
Width of body, greatest	28
Foreleg	32.5
Longest finger	13
Hind leg	63
Femur	20.5
Tibia	20
Foot	23
Longest toe	16.5

*Variation.*—There are twenty-eight specimens in my collection from Bunawan, all taken in the same immediate locality. They exhibit very striking variations in color and markings and slight variations in amount of webbing of toes, the pointedness of the nose, and comparative length of limbs. The typical pattern is the one described. The sacral spots are usually present, of varying size; but in one specimen they are entirely wanting, and in another the spot is wanting on one side and represented on the other by a very small dark area. In some specimens the nose is sharply pointed, ending in a small tuberclelike prominence; in others it is bluntly pointed, and in still others the snout is rather truncate; in some the skin is comparatively smooth, in others uniformly granular. The thick glandular structure of the skin is more evident in the largest specimens. It appears as a huge parotoid covering the entire back and sides. One specimen shows two distinct lateral black spots other than the inguinal spot.

*Remarks.*—The type of *Kalophrynus stellatus* measures only



24 millimeters and is doubtless an immature form of the specimen described here. The variations are obvious. Stejneger states that there is no supratympanic ridge. In young specimens in my collection the fold is very dim, but distinct in older ones; the "small star-shaped spots" are rarely evident on the back, but on breast and belly they are usually numerous, although frequently entirely wanting. The smallest specimen in the collection measures only 15 millimeters.

It is not improbable that *Kalophrynus stellatus* and *K. acutirostris* are merely variations of the same species. It will be noted that I have described a specimen of very nearly the same size as the type of *K. acutirostris*. The limbs are distinctly longer than in Boettger's species.

*Kalophrynus stellatus* is common in western Mindanao, especially in the swampy forests of the upper Agusan country. They are usually encountered hopping about during or after a rain; they are very clumsy and very easily captured. During the breeding season of *Kaloula conjuncta* at Bunawan several male specimens of *Kalophrynus stellatus* were taken clasping females of the other species. In spite of their being common I failed to discover their tadpoles. Several females in the collection, including the one described, are packed with eggs. The eggs are small, measuring about 1 millimeter in diameter.

This species is known from Bunawan, Agusan, in Mindanao, and from Basilan. Three specimens were collected by myself in the latter island, which is the type locality. The types were collected by E. A. Mearns.

*Kalophrynus acutirostris* (Boettger).

*Calophrynus acutirostris* BOETTGER, Zool. Anz. 20 (1897) 165.

*Kalophrynus acutirostris* STEJNEGER, Proc. U. S. Nat. Mus. 33 (1908) 576.

*Description of species.*—(After Boettger.) No vomerine teeth present, tongue almost circular, as wide as long; snout sharp, peak-shaped; the outer metatarsal tubercle very indistinct; thighs comparatively short; the tibiotarsal articulation reaches only to the posterior edge of the tympanum; skin on back finely granulated, the granules of equal size; tympanum four-fifths of eye; head wider than long.

*Color.*—Above grayish red with very indistinct, darker, island-like branched spots; head and sides of back darker, almost blackish, bordered above with a fine whitish longitudinal line; in the anal region a whitish transverse line; thighs with darker transverse bands; no round, dark, light-bordered inguinal spot.

*Measurements of Kalophrynus acutirostris (Boettger).*

	mm.
Length, snout to vent	44
Head length	12
Width of head	15
Diameter of eye	5
Tympanum	4
Foreleg	27
Hind leg	51
Femur	19
Tibia	17.5
Foot	23

*Remarks.*—This species differs from *Kalophrynus pleurostigma* Tschudi in having the subcircular tongue, the snout more protracted, the hind legs shorter, and the inguinal spots lacking. It also differs from *K. stellatus* in having the subcircular tongue, the snout pointed, the hind legs shorter, and no sacral spots. The species is known from a single specimen. It is from either Samar or Culion (“entweder von Culion oder von Samar”);<sup>31</sup> the exact locality is no longer known.

Genus *CHAPERINA* Mocquard

*Chaperina* MOCQUARD, Mem. Soc. Zool. France 5 (1892) 194; Le Natural 14 (1892) 35.

Tongue elliptical, not forked behind, free; no vomerine teeth; rather indistinct body ridge across the palate behind choanæ sometimes present; on posterior part of palate in front of œsophagus one or two dermal folds, choanæ rather large, hidden under edges of maxilla; tympanum present or wanting; fingers and toes entirely free, dilated into small disks; no paratoid gland; inner metatarsal tubercle present; terminal phalanges T-shaped; outer metatarsals united. Pupil horizontal; precoracoids present, very slender; sternum cartilaginous; no omosternum. Transverse process of sacrum rather strongly dilated.

*Remarks.*—This genus was established for *Chaperina fusca* Mocquard from Sintang, Borneo. Mocquard states that it is most closely related to *Sphenophryne* Peters and Doria. Two species are known from the Philippines, both new. *Chaperina beyeri* is closely related to *C. fusca* but appears to differ in certain organic characters, such as the presence of a distinct dermal soft spine on the heel and the absence of tympanum.

<sup>31</sup> Boettger, loc. cit.

*Key to the Philippine species of Chaperina Mocquard.*

- $\alpha^1$ . Black above, with or without yellow specks; yellow below reticulated with black; dermal spine on heels; belly smooth..... *C. beyeri* sp. nov.  
 $\alpha^2$ . Brown above, with a median white stripe; two light areas on either side of back and a ) (-shaped light mark extending in front on either side of anus; belly granular on dermal spine..... *C. visaya* sp. nov.

*Chaperina beyeri* sp. nov. Plate 3, fig. 3.

*Type*.—No. 557, E. H. Taylor collection; collected in upper Agusan, Mindanao, between Agusan and Simulao Rivers (probably in Davao or near the Davao-Agusan line), June, 1913, by E. H. Taylor.

*Description of type*.—Vomerine teeth wanting; choanæ moderate, rather hidden under edges of jaw; a small bony ridge across palate in front of eyes and behind choanæ, somewhat angular medially; a small dermal ridge, rather indistinct in hinder part of palate; head wider than long; snout short, truncate; nostrils nearer tip of snout than eye, distance between them much greater than their distance from eye; eye rather small, diameter somewhat less than length of snout; pupil appears round; interorbital width more than one and two-thirds times eyelid; tympanum wanting, but a slight depressed area in temporal region evident in dried or overpreserved specimens; a distinct groove from tympanic region to arm with a very indistinct fold above the groove; fingers unwebbed, with well-developed disks; first finger very short, with only small terminal disk, and only reaches base of second; fourth longer than second, reaching base of disk on third; subarticular tubercles large; elbow with a distinct dermal spine; toes unwebbed, with distinct terminal disks; first toe reaches subarticular tubercle of second; third much longer than fifth; heel with a distinct, sharp, dermal spine; hind limb brought forward, the tibiotarsal articulation reaches eye; skin smooth both on entire upper and on lower surface. Male apparently without vocal sac.

*Color in life*.—Above dark brown to blackish; on sides of head and body, on posterior part of back, and above limbs are small lemon yellow dots of varying size; limbs very dimly marked with irregular darker bars; dermal spines on limbs yellow; belly and underside of limbs yellow to orange spotted, and reticulated with brownish, forming rather rounded yellow spots; a distinct light spot at base of digital disk above and below; subarticular tubercles black, some with a dividing whitish line.



*Measurements of Chaperina beyeri sp. nov.*

	mm.
Length, snout to vent	23
Width of head	7
Length of head	6
Width of body	12
Length of snout	3
Diameter of eye	2.5
Tibia	12
Foreleg	13
Hind leg	33.5

*Variation.*—Specimens from Palawan agree very well in most characteristics; some are darker, almost coal-black with practically no yellow or white dots above, while others are lighter, gray-brown, with black-brown bars on legs, and very indistinct markings on back; males appear to have more dusky markings on throat than females. Mindanao specimens have the ground color of throat dark, with roundish yellow spots.

*Tadpoles.*—A good series of tadpoles was taken, from specimens with no legs to those that had completed their transformation. Description of specimen: Total length, 23 millimeters; body, 9; tail, 14; hind legs 10. Eyes very distinct, lateral, distance between them more than twice their distance to end of snout; nostrils close together, nearer tip of snout than eye; spiracle on left side. Owing to the state of preservation I am unable to determine the characters of the teeth and labial denticulation. Color blackish, rather lighter below.

*Remarks.*—This species was first discovered in June, 1913, in the low mountains along the boundary of Davao and Agusan Provinces, Mindanao, between Agusan and Simulao Rivers. Several adults were taken in a small pool of water in a hole in a tree trunk, only about one-third meter above ground. In May, 1918, several specimens were taken in the extreme northern part of Palawan. Young and adult specimens were found under rocks along nearly dry stream beds in low mountains; later tadpoles were found in a water-filled cavity, nearly a meter from the ground, close to the base of a large tree, not far from the same stream. A good series of tadpoles was taken, as well as a few recently transformed young. In the same pool of water another large tadpole was taken, but I am unable to identify it.

The adults are very agile and, owing to their small size and dark color, are seen only with difficulty. Certainly common in northern Palawan, but probably rare in Mindanao. Known from only these two localities in the Philippines.

I take pleasure in naming this species for Prof. H. Otley Beyer, of the University of the Philippines, who assisted in making collections.

*Chaperina visaya* sp. nov. Plate 9, fig. 3.

*Type*.—No. B80, Bureau of Science collection; collected on Biliran Island, P. I., May, 1914, by R. C. McGregor.

*Description of type*.—Head broader than long; tongue oval, not notched behind; choanæ small, nearly hidden under edge of jaw; no vomerine teeth or palatal ridge; two transverse dermal ridges in front of œsophagus, the anterior rather arched; eye large, its diameter equal to its distance from tip of snout; canthus rostralis rounded; lores vertical, not concave; snout rounded, projecting somewhat; nostril nearer tip of snout than eye; interorbital region nearly twice the width of upper eyelid; tympanum not visible; a very dim fold from eye to foreleg; skin above smooth, with two prominent tubercles on shoulders; numerous other tubercles on posterior part of back, sides and limbs; a skin fold from angle of jaw to foreleg; fingers free, with broad disks, second and fourth nearly same length; sub-articular tubercles dim; toes free, with disks smaller than those on fingers; a flat outer metatarsal tubercle, inner dim or wanting; subarticular tubercles dim; the tibiotarsal articulation fails to reach eye.

*Color in formalin*.—Above variegated brown with a somewhat darker area on head; a median very narrow light line; two rather large light spots on either side of middle of back with an H-shaped mark extending above and on either side of anus. These markings, together with the dorsal, give an appearance of a caricature of a man's face; under surface of belly and limbs dirty white; chin darker than belly.

*Measurements of Chaperina visaya* sp. nov.

	mm.
Snout to vent	19.5
Width of head	7
Length of head	6.5
Diameter of eye	2.8
Length of snout, from eye	3
Interorbital distance	3.5
Foreleg	12
Hind leg	28
Femur	9
Tibia	9
Longest toe	8.8

*Remarks.*—The type is the only specimen known. It is with some hesitancy referred to the genus *Chaperina* as it differs somewhat from that genus in the palatal characters. It is not improbably a species of *Sphenophryne*. No specimen of that genus is at hand for study.

Genus **PHRYNIXALUS** Boettger

*Phrynixalus* BOETTGER, Zool. Anz. 18 (1895) 17; STEJNEGER, Proc. U. S. Nat. Mus. 33 (1908) 573.

No vomerine teeth; with or without a doubly arched palatal ridge; a smooth dermal ridge in front of Eustachian tubes and another denticulated one behind them; tongue large, rounded, free; tympanum present; fingers and toes free, with disks; no subarticular tubercles; no metatarsal tubercles; pupil horizontal.

*Remarks.*—In this genus, only *Phrynixalus annulatus* Stejneger is known from the Philippine Islands. This differs somewhat from the genotype, in that it lacks the doubly arched palatal ridge.

*Phrynixalus annulatus* Stejneger.

*Phrynixalus annulatus* STEJNEGER, Proc. U. S. Nat. Mus. 33 (1908) 573.

*Description of species.*—(From Stejneger.) “No vomerine teeth; no ridge between or behind the choanæ which are large, but nearly concealed by the overhanging lip; an indistinct, smooth dermal ridge between the eustachian tubes, and a well-marked denticulated one behind them; tongue large, rounded behind, extensively free (about one-half) behind and on sides; snout somewhat acuminate, projecting; nostrils much nearer tip of snout than eyes; distance from tip of snout to eye greater than diameter of latter; interorbital space nearly twice as wide as upper eyelid; canthus rostralis rounded; lores concave; tympanum rather distinct, its diameter about one-half that of the eye; fingers free, club-shaped, first very much shorter than second, much less widened at the tip than the others, the tips of which are nearly truncate; toes entirely free, the tips dilated, but not quite so much as the fingers; no subarticular tubercles and no metatarsal tubercles; outer metatarsals united; skin smooth above; upper eyelid granular with a larger and more prominent tubercle near the middle of the palpebral edge; underside smooth, except belly which is faintly areolated, and the preanal region, which is granular.”

*Color (in alcohol).*—“Dark brown above, with an indistinct pale band between the anterior half of the upper eyelids followed



by a dusky cross-bar; on the shoulders a large, indistinct, W-shaped, dusky mark, the outer arms of which anteriorly reach to the posterior corner of the eyes; an indistinct, large, pale spot on each side of the sacrum; an oblique, pale, dusky-edged line from eye to fore leg; underside paler brown, minutely dotted with whitish; limbs like the body, faintly mottled with dusky, but without distinct cross bars; fingers and toes with a very distinct dusky ring behind the expanded tip or disk, followed by an equally distinct ring of whitish color."

*Measurements of Phrynixalus annulatus Stejneger.*

	mm.
Total length, tip of snout to vent	14.5
Tip of snout to tympanum	4.5
Width of head	5.0
Length of foreleg	8.5
Length of hind leg, from vent to tip of longest toe	20.0
Length of tibia	6.0

*Remarks.*—This species was discovered in Davao, Mindanao, in 1904, by E. A. Mearns. Two specimens were taken, one on Mount Apo, at an elevation of about 1,230 meters. This species differs from other members of the genus by the absence of the doubly arched ridge across the palate, and by the difference in the shape of the pupil of the eye.

### BUFONIDÆ

No maxillary teeth present; diapophyses of sacral vertebræ dilated; vertebra procœlian and without ribs; the coccyx attached to two condyles; omosternum generally absent; distal phalanges obtuse or T-shaped; pupil usually horizontal.

The true toads belong to this group. It is a large family, cosmopolitan in distribution. There are comparatively few genera in the family. More than three-fourths of the known species belong to the genus *Bufo*. Two genera are known from the Philippines, *Bufo* and *Nectophryne*.

*Key to the Philippine genera of Bufonidæ.*

a.<sup>1</sup> Fingers slightly webbed; toes webbed, the tips more or less dilated into disks; pupil horizontal; terminal phalanges T-shaped.

*Nectophryne* Buchholz and Peters.

a.<sup>2</sup> Fingers free; toes more or less webbed, with or without disks; terminal phalanges simple..... *Bufo* Laurenti.

### Genus NECTOPHRYNE Buchholz and Peters

*Nectophryne* BUCHHOLZ and PETERS, Mon. Beri. Ak. (1875) 202;

BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 279; ROUX,

Proc. Zool. Soc. London (1906) 58.

*Pedostibes* GÜNTHER, Proc. Zool. Soc. London (1875) 576.

Toadlike; pupil horizontal; tympanum distinct, partly hidden or absent; fingers and toes partially or wholly webbed, tips dilated into distinct disks; outer metatarsals united; no omosternum; sternum cartilaginous; diapophyses of sacral vertebrae dilated; terminal phalanges T-shaped.

The distribution of this genus is rather unusual, as far as it is known. Species are known from West Africa and from East Africa; six species have been recorded from Borneo, one of which occurs also in the Natuna Islands and Singapore; one species is found in Malabar; and I have recently found a species in Mindanao.

*Nectophryne sundana*, described by Peters from Borneo, has been considered as a doubtful species by both Boulenger and Roux; in his review of the genus the latter does not include the species but remarks:

I conclude with a synoptic table for the determination of the known species of *Nectophryne*, not taking into consideration doubtful species, as e. g. *Nectophryne sundana* (Ptrs.) (Boulenger, Cat. Batr. Sal. p. 281.) I have not been able to examine the only existing specimen of this species, which is preserved in the Berlin Museum and comes from Borneo.

It is significant that Roux does not notice the record of this species from Mindanao, recorded by F. Müller<sup>32</sup> and listed by Boettger.<sup>33</sup> It would appear that this specimen has disappeared or, what is still more likely, has been referred to some other species or genus. At any event, I shall not include the species on the strength of the Müller report. Whether or not the specimen that Müller had before him was of the species here described is a matter of conjecture.

*Nectophryne lighti* sp. nov. Plate 7, figs. 3 and 3a.

*Type*.—No. 189, E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., July, 1913, by E. H. Taylor.

*Description of type*.—Choanæ moderately large, hidden under the overhanging jaw; body not especially slender; head slightly longer than broad; snout distinctly truncate with a groove between the rather raised prominences in which the nostrils are pierced; nostrils near extreme end of snout; in profile the snout slopes back and down to mouth in a rather concave line; eye large, its length a little greater than the length of snout; tympanum large, its greatest diameter about two-thirds that of eye, separated from eye by a distance equal to about one-third its

<sup>32</sup> III Nachtr. Cat. Herp. Samml. Basel Mus. (1883) 7.

<sup>33</sup> Ber. Senck. Nat. Ges. (1886) 125.

greatest length; interorbital distance about twice the width of upper eyelid, much greater than the length of snout; the interorbital area and occipital area raised somewhat; loreal region vertical, concave; skin above with large tubercles, which are moderately smooth, very numerous dorsolaterally and along sides; middle part of back comparatively smooth; a rather prominent parotoidlike tubercle on each shoulder; temporal regions strongly tubercular; top of head, save eyelids, smooth; chin, throat, and belly free from granules; limbs very slender; fingers very slightly dilated at tips, truncate, webbed, the membrane between fingers reaching more than halfway on first and second fingers; first finger about half the length of second; toes about three-fourths webbed, the membrane reaching tip of first and second toes and tip on outer side of third.

*Color*.—Chestnut brown above, with occasional lighter areas; rather darker on sides; a distinct cream-yellow spot begins below anterior part of eye and continues to below tympanum; three small cream spots behind angle of mouth; limbs lighter, with darker chestnut markings; feet and hands yellowish brown; dusky yellowish brown below, with irregular white spots, which also occur low on sides.

*Measurements of Nectophryne lighti sp. nov.*

	mm.
Length, snout to vent	15
Length of head	5.2
Width of head	5
Length of snout	1.5
Foreleg	10.8
Hind leg	21
Tibia	65
Femur	6
Longest toe	5

*Remarks*.—Only a single specimen known. It is from Bunawan, Agusan, where it was taken in a forest among leaves, a few hundred meters from water.

Just what relation this species bears to the Borneo species, I cannot say. It is, however, clearly distinguished by the very numerous large tubercles on its back and sides. It agrees with *Nectophryne guentheri* Boulenger in having the skin of the sides attached to the leg, but differs from the latter not only in size and number of tubercles, but also in having a broader interorbital distance, with apparently no metatarsal tubercles.

The species is dedicated to Prof. Sol F. Light, of the University of the Philippines, who has manifested much interest and given assistance in this work.



## Genus BUFO Laurenti

*Bufo* LAURENTI, Syn. Rept. (1768) 25; WAGLER Syst. Amph. (1830) 206; TSCHUDI, Class. Batr. (1838) 88; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 662; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 55; COPE, Nat. Hist. Rev (1865) 102; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 281; STEJNEGER, Bull. U. S. Nat. Mus. 58 (1907) 55.

*Hylaplesia* BOIE, Isis (1827) 294; PETERS, Mon. Berl. Ak. (1867) 34.  
*Phrynoides* COPE, Proc. Acad. Nat. Sci. Philadelphia (1863) 357.

"Pupil horizontal. Tongue elliptic or pyriform, entire and free behind. Vomerine teeth none. Tympanum distinct or hidden, seldom absent. Fingers free; toes more or less webbed, the tips simple or dilated into small disks. Outer metatarsals united. Omosternum generally missing; if present, cartilaginous; sternum a cartilaginous plate; sometimes more or less ossified along the median line. Diapophyses of sacral vertebra more or less dilated. Terminal phalanges obtuse or triangular." (*Boulenger.*)

Key to the Philippine species of *Bufo* Laurenti.

- a<sup>1</sup>. Crown without bony ridges; toes with well-developed disks.
  - b<sup>1</sup>. First finger shorter than second; toes half webbed; no metatarsal tubercles; two small parotoids on each side..... *B. brevipes* (Peters).
  - b<sup>2</sup>. First finger much shorter than second, not any or but slight disks; toes webbed to the tips; no parotoids..... *B. muelleri* Boulenger.
- a<sup>2</sup>. Crown with bony ridges.
  - b<sup>1</sup>. Cranial ridges distinct, curving behind eye to tympanum; no parietal ridges ..... *B. melanostictus* Schneider.
  - b<sup>2</sup>. Cranial ridges usually confluent with parietal ridges.
    - B. philippinicus* Boulenger.

*Bufo brevipes* (Peters).

*Hylaplesia brevipes* PETERS, Mon. Berl. Ak. (1867) 34.

*Bufo brevipes* BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 287; BOETTGER, Ber. Senck. Nat. Ges. (1886) 125; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1895) 452.

*Description of species.*—Habit rather slender; crown without bony ridges; snout obliquely truncate with angular canthus rostralis; loreal region vertical; interorbital space broader than upper eyelid; tympanum rather distinct; sides of body thickly ornamented with tubercles; two small parotoid glands on each side, one on neck, the other near shoulder; foreleg reaches posterior end of body; first finger very short, projecting like a small tubercle; tips of fingers dilated into well-developed disks; third finger 2 millimeters in length; palm of hand smooth; first three

toes scarcely extend beyond the swollen interdigital skin; first and last toes as long as corresponding fingers; toes with disks similar to those on fingers; sole of foot smooth, with no metatarsal tubercles present; hind limb brought forward reaches to center of eye. (After Peters.)

*Color.*<sup>34</sup>—Presumably blackish brown above, with white spots, beneath marbled brown.

*Measurements of Bufo brevipes (Peters).*

	mm.
Length, snout to vent	18
Foreleg	13
Hind leg	23
Femur	7
Tibia	7
Tarsus	4
Entire foot	10

*Remarks.*—The types are from Zamboanga, Minadanao, and were collected by Semper. Only the two type specimens appear to have been found. I believe it has not been rediscovered.

*Bufo muelleri* Boulenger.

*Bufo muelleri* BOULENGER, Ann. & Mag. Nat. Hist. V 20 (1887) 52.

*Description of species.*—(From Boulenger.) "Closely allied to *B. pulcher* Boulenger. Crown without bony ridges; snout short, obliquely truncate, with perpendicular lores; interorbital space broader than the upper eyelid; tympanum very indistinct, fingers rather long, somewhat widening and truncate at the end, first much shorter than second; toes rather short, webbed to the tips, which are slightly swollen; metatarsal tubercles, two, flat and very indistinct; the membrane bordering the inner toe extends as a fine fold along the tarsus. The tibio-tarsal articulation reaches the anterior border of the orbit. Skin nearly smooth above, granular inferiorly; no parotoids. Black above with lighter wavy lines or marblings, and with round white dots on the sides and limbs; throat and belly marbled with brown. Male with a subgular vocal sac."

"From snout to vent 30 millim."

*Remarks.*—The type, a male specimen from Mindanao, is in the British Museum of Natural History. No other specimen is known.

<sup>34</sup> Said to agree with *Bufo borbonicus* Boie.

*Bufo melanostictus* Schneider.

- Bufo melanostictus* SCHNEIDER, Hist. Amph. 1 (1799) 216; GRAVENHORST, Delic. Mus. Vratislav. (1829) 57; CANTOR, Cat. Mal. Rept. (1847) 142; GIRARD, U. S. Expl. Exp., Herp. (1858) 92, pl. 5, figs. 10-14; GÜNTHER, Rept. Brit. India (1864) 422; STEINDACHNER, Novara Exped., Zool. 1, Amph. (1869) 42; STOLICZKA, Proc. As. Soc. Bengal (1870) 155; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 306; Fauna Brit. India, Rept. (1890) 505; BOETTGER, Offenb. Ver. Naturk. (1885) 131; FLOWER, Proc. Zool. Soc. London (1896) 911, pl. 44, fig. 3; BOETTGER, Ber. Senck. Nat. Ges. (1886) 125; CASTO DE ELERA, Cat. Fauna Filipinas 1 (1896) 452; STEJNEGER, Bull. U. S. Nat. Mus. 58 (1907) 73, figs. 58-61.
- Bufo scaber* DAUDIN, Hist. Nat. Rain. (1803) 94, pl. 34, fig. 1; Rept. 8: 194; TSCHUDI, Class. Batr. (1838) 88; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 699; SCHLEGEL, Abbild. Amphib. (1837) 64, pl. 20, fig. 2; VAN KAMPEN, Zool. Ergeb. Max Weber's Reise 4 (1907) 2, 416.
- Bufo bengalensis* DAUDIN, Hist. Nat. Rain. (1803) 96, pl. 35, fig. 1; LESSON in Bélang. Voy. Ind. Or., Rept., 334.
- Bufo isos* LESSON in Bélang. Voy. Ind. Or., Rept., 333; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 702.
- Bufo gymnauchen* BLEEKER, Nat. Tijdschrift Nederl. Ind. 16 (1858) 46.
- Phrynoides melanostictus* COPE, Proc. Acad. Nat. Sci. Philadelphia (1863) 357.
- Bufo spinipes* STEINDACHNER, Novara Exped., Zool. 1, Amph. (1869) 42.
- Bufo meranostictus* STEJNEGER, Journ. Sci. Coll. Tokyo 12 (1898) 216 (typ. err.).

*Description of species.*—(From Stejneger.) "Head with strongly developed bony crests, involving the upper lip, a rostral ridge on end of snout from lip to between nostrils, there bifurcating and continuing on canthus rostralis, along supraorbital border to above the tympanum, forming there a knob-like prominence and sending a branch downward along the anterior border of the tympanum; a slight parietal spur indicated, also a short anteorbital spur or crest; nostrils nearer the tip of the snout than the eye; interorbital space deeply concave, much wider than upper eyelid, which is strongly tubercular and with thickened glandular edges; tympanum vertical, oval or almost pear-shaped, separated from the orbit by a very narrow space, its longest diameter about three-fourths the diameter of the eye; parotoids large, swollen, kidney-shaped; first finger reaches considerably beyond second which does not quite reach as far as fourth; an elongate inner and a much larger outer palmar tubercle;



subarticular tubercles single, prominent; palm, underside, and edges of fingers with numerous pointed tubercles, which, like all the other digital tubercles and the horny tip of the fingers, are blackish brown; heels just meeting when hind legs are placed at right angles to axis of body; metatarsal tubercles reaching posterior corner of eye when hind legs are placed forward along the sides of the body; toes less than one-half webbed, the webs being greatly excised and their edges sharply denticulate; inner metatarsal tubercle prominent, oval, shorter than first toe, outer one large, rounded, less prominent; the single subarticular tuber-



FIG. 9. *Bufo melanostictus* Schneider. After Stejneger. *a*, top of head; *b*, side of head; *c*, hand; *d*, foot.

cles, plantar tubercular asperities, and tip of toes like those on the fore foot; skin strongly tubercular, the tubercles on the back larger, more distant, glandular, rounded, those on sides and limbs more prominent, almost conical, all with a horny dark-brown tip, which on sides and limbs becomes spinous."

*Color (in alcohol).*—"Clay-colored above, more pure pale ocher-yellow underneath, all the crests and nearly all the tips of the tubercles dark brown, as are also the elevated fine vermiculations on the surface of the parotoids; indistinct dusky spots and coarse vermiculations on limbs, sides, throat, and breast."

*Measurements of Bufo melanostictus Schneider.*

	mm.
Tip of snout to vent	84
Tip of snout to anterior border of tympanum	20
Nostril to tympanum	16
Internaral width	5
Interorbital width	8.5
Longest diameter of tympanum	5.5
Width of head	31
Foreleg	50
Hind leg, from vent to tip of longest toe	99
Tibia	26
Hind foot, from base of inner metatarsal tubercle to tip of longest toe	30
Length of parotoid	20
Width of parotoid	8

*Remarks.*—This species is included on the strength of Boulenger's record of a female specimen from "Philippine Islands."<sup>35</sup> The fact that no further specimen has been taken in the Philippines leads me to believe that it must be extremely rare here or that the record is in error.

*Bufo philippinicus* Boulenger. Plate 9, fig. 5.

*Bufo philippinicus* BOULENGER, Ann. & Mag. Nat. Hist. V 19 (1887) 348, pl. 10, fig. 5; VI 14 (1894) 88.

*Bufo divergens* MOCQUARD, Nouv. Arch. du Mus. III 2 (1890) 158.

*Description of species.*—(From No. R1760, Bureau of Science collection; collected at Taytay, Palawan, P. I., April, 1913, by L. E. Griffin.) Choanæ longer than wide, well in view; no vomerine teeth; palate with a transverse denticulated bony ridge, more or less interrupted mesially; head angular, distinctly wider than long; canthus rostralis with low bony crests, which continue back between the eyes to occipital region, where they join the occipital ridges, become confluent with them, and make an angular turn inward; a branch is given off immediately behind eye which curves around, ending at the anterior outer edge of parotoid; posterior part of bony crests higher and thicker than anterior part; distance between crests greatest just posterior to eye; eye large, its length equal to length of snout; eyelid projecting strongly, its width about equal to interorbital space between the bony crests; nostril much nearer tip of snout than eye; canthus rostralis angular, sloping very gently; loreal region not or but slightly concave; tympanum oval, its outline very distinct except on upper border, its diameter about two-thirds eye; distance between tympanum and eye equal to about half

<sup>35</sup> Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 307.

the greatest diameter of latter; parotoids large, very distinct, slightly oblique, one and two-thirds times as long as broad; temporal area behind crests depressed; eyelids strongly tubercular; a prominent tubercle on both anterior and posterior corners of eyelid; entire upper surface with spiny tubercles of unequal size, the largest ones in the median dorsal region; large spiny tubercles behind angle of jaws to above arm; a distinct single tubercle between parotoid and end of occipital crests; entire upper surface of limbs, as well as soles of feet, with spiny tubercles; belly, throat, and underside of limbs with rather uniform small granules; fingers without web; first finger thick, extending farther than second or fourth; a large, keeled, oval tubercle on palm as long as second finger; a smaller conical tubercle on outer base of first finger; subarticular tubercles not very distinctly differentiated from other granules; toes about one-third webbed, third toe distinctly longer than fifth; a strong inner metatarsal tubercle as long as first toe; strong flat oval outer tubercle; subarticular tubercles not well differentiated from other granules; tibiotarsal articulation reaches a little beyond posterior part of parotoid.

*Color in alcohol.*—Above uniform brownish, no markings being visible; sides dark brown to black; head lighter variegated brown; parotoids lighter brown than back; limbs with very indistinct darker and lighter marks; below dirty yellowish brown, with spots and mottlings of brownish.

*Measurements of Bufo philippinicus Boulenger.*

	mm.
Length, snout to vent	76
Length of head	21
Width of head	26
Diameter of eye	8.5
Diameter of tympanum	6.1
Length of snout	9
Depth of head, in front of eye	9
Depth of head, at tympanum	11.5
Length of parotoid	13
Width of parotoid	7
Foreleg	43
Longest finger	15
Hind leg	80
Femur	26
Tibia	25
Foot	35.5
Longest toe	22

*Variation.*—There are three adult specimens of this species in the Bureau of Science collection, two of which were taken from the stomachs of *Boiga dendrophila* Boie, from Palawan.



In one of the specimens the occipital ridges are higher and blunter than in the one described. In a Balabac specimen, which is about half grown, the low ridge following the canthus rostralis and that between the eyes form a distinct angle at the anterior corner of the eye and then a second angle is formed at the union of the occipital ridge with the interorbital ridge; the connection between the supratympanic ridge and the occipital ridge behind the eye is very indistinct; the parotoid gland is as long as its distance to the anterior corner of the eye. The specimen is a male, showing the internal openings to the vocal sacs. There is a rather distinct skin fold from the parotoid back toward the groin, surmounted by rather large tubercles, which is only dimly evident in the specimen described, where the markings are indistinct, and the limbs dimly barred.

A young specimen from northern Palawan (42 millimeters) has distinct markings, but the cranial ridges are dim or wanting. As shown by my specimens, the cranial ridges are variable in arrangement and distinctness and the relative length of limb and body varies.

Specimens collected by myself were found along streams in the low mountains of northern Palawan and Busuanga, during rain storms. The type was collected at Puerto Princesa in Palawan by A. Everett.

#### PELOBATIDÆ

Upper jaw toothed; vomerine teeth frequently present; diaphyses of sacral vertebræ strongly dilated; terminal phalanges simple; vertebræ procelous or opisthocelous; pupil vertical.

The family is widely distributed, but has comparatively few species. It is found in Europe, India, Malasia, and central North America. Only one genus, *Megalophrys*, has been recognized in the Philippine fauna.

#### Genus MEGALOPHRYS Kuhl

*Megalophrys* KUHL, Bull. Sc. Nat. 2 (1824) 83; WAGLER, Syst. Amph. (1830) 204; TSCHUDI, Class. Batr. (1838) 82; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 456; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 36; COPE, Nat. Hist. Rev. (1865) 107; Journ. Acad. Nat. Sci. Philadelphia II 6 (1866) 80; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 442.

*Ceratophryne* GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 136.

*Leptobrachium* TSCHUDI, Class. Batr. (1838) 81; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 36; COPE, Nat. Hist. Rev. (1865) 107; Journ.

Acad. Nat. Sci. Philadelphia II 6 (1866) 80; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 440; Fauna Brit. India, Rept. (1890) 510.

*Xenophrys* GÜNTHER, Rept. Brit. India (1864) 414; COPE, Nat. Hist. Rev. (1865) 107; Journ. Acad. Nat. Sci. Philadelphia II 6 (1866) 80; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 441.

"Pupil erect. Tongue circular or pyriform, entire or nicked and free behind. Vomerine teeth in two small groups, if present. Tympanum distinct or hidden under the skin. Fingers free, toes free or shortly webbed; outer metatarsals united. Sternum with a bony style. Coccyx, if distinct from the sacral vertebra, with simple articulation." (*Boulenger.*)

*Key to the Philippine species of Megalophrys Kuhl.*

*a*<sup>1</sup>. Eyelid with dermal spine.

*b*<sup>1</sup>. Males with an internal vocal sac; without vomerine teeth.

*M. stejnegeri* sp. nov.

*b*<sup>2</sup>. Males with vocal sacs; vomerine teeth present..... *M. ligayæ* sp. nov.

*b*<sup>3</sup>. Males without vocal sac; vomerine teeth present.. *M. montana* (Kuhl).

*a*<sup>2</sup>. Eyelid without dermal spine; no vomerine teeth; males with vocal sac.

*M. hasselti* (Tschudi).

The genus has been admirably reviewed by Boulenger;<sup>36</sup> he has included figures of six species. The species of the genus are confined to southeastern Asia, the Malayan Archipelago, and the Philippines. Whether three or four species should be included in the Philippine fauna is still a question. Before this can be considered settled, a reëxamination of Philippine specimens in European museums referred to *M. montana* will be necessary. I include that species as doubtfully belonging to our fauna.

*Megalophrys stejnegeri* sp. nov. Plate 10, figs. 1 and 1a.

*Type*.—No. F315 E. H. Taylor collection; collected at Bunawan, Agusan, Mindanao, P. I., August 10, 1912, by E. H. Taylor.

*Description of type*.—Vomerine teeth wanting; choanæ large, concealed by the overhanging jaw, bounded behind by the bony palatal ridge, the distance between them less than the distance between nostrils; tongue entire without evidence of a nick; (males with vocal sac); head very large, about one and one-half times as long as broad; eyes large, prominent, their diameter distinctly longer than the length of snout; distance between nostrils greater than their distance from eyes; canthus rostralis distinct, angular; loreal region vertical, somewhat concave;

<sup>36</sup> Proc. Zool. Soc. London 1 (1908) 410.

snout small, truncate, projecting over lower jaw with a small tubercular tip; nostril much nearer tip of snout than eye; tympanum irregularly oval, rather indistinct, separated from eye by a distance equal to much more than greatest diameter of tympanum; jaw semicircular in outline, almost hidden when viewed from above; a bonelike ridge from eye to above tympanum; interorbital space little more than one and one-half times the width of upper eyelid (exclusive of horn), its greatest diameter from one-half to two-thirds that of eye; skin of body rather smooth with folds and occasional, irregular tubercles; skin of occiput rather involved in the cranial ossification; a distinct dermal spine, or horn, points outward from the middle of outer edge of upper eyelid, its length a little more than half the width of eyelid; upper eyelid granular; a skin fold follows the bony ridge above tympanum, and continues back and down to near arm; a small dermal spine at angle of jaw; an enlarged, more or less distinct, short glandular fold above insertion of arm; a distinct transverse fold behind head; two dorsolateral skin folds reaching a little more than two-thirds the distance to end of body, and beginning behind the skin fold that delineates the head; breast with two mammalike rounded tubercles, one on either side; skin on chin smooth; belly with scattered blunt tubercles; hind limbs with dim, narrow, transverse granular folds; no tarsal fold; fingers very slightly swollen at tips; first finger slightly shorter than second; second and fourth of nearly equal length; subarticular tubercles very indistinct, forming more or less continuous longitudinal ridges; a dim tubercle at base of first finger; toes slightly dilated at tip, with a mere rudiment of web at base; subarticular tubercles wanting or indistinct; a large, flat, prominent inner metatarsal tubercle; no outer tubercle; tibiotarsal articulation reaches halfway between eye and tympanum.

*Color in life.*—Above olive brown, anterior part of head slightly lighter than back; a dim, angular, lighter stripe across head; indistinct mottling on head and back; sides with occasional tubercles, usually of darker color, but yellow tipped; a canthal black streak; upper lip mottled brown, a brownish area below eye involving a distinct black spot behind eye; arm strongly barred with dark brown; fingers also barred; hind leg and foot barred brown; chin dusky brown spotted with darker, and with two dim, longitudinal, lighter yellowish lines; two yellow spots on breast; belly yellowish with brown mottlings.



*Measurements of Megalophrys stejneri sp. nov.*

	mm.
Length, snout to vent	64
Length of head, from jaw	21
Width of head	30
Eye to tip of snout	8
Diameter of eye	9
Diameter of tympanum	4.5
Interorbital distance	9.2
Foreleg	39
Longest finger	15.5
Hind leg	86.5
Femur	27
Tibia	23.5
Foot	37
Longest finger	22

*Variation.*—This species, like *Megalophrys montana*, is variable in many characters. In Mindanao specimens the fingers vary in length. Sometimes the first, second, and fourth fingers are equal, and sometimes they vary progressively in length, but in none of the specimens is the difference great; the nostrils are much nearer tip of snout than eye; the tympanum is not clearly outlined, and is frequently somewhat triangular in shape, with or without a narrow, fairly distinct ridge bounding it in front; the vomerine teeth are constantly absent in the series at hand; a semicircular skin fold is frequently present in the middle of the back, arched forward; in some specimens the tongue has a small nick behind; the males have vocal sacs. The markings vary, chiefly in intensity; the black mark behind and somewhat below eye is invariably present. In younger specimens there are two rather distinctly defined cranial ridges running back from a point where the anterior part of eye meets canthus. These are not visible in the type, which is probably a full-grown female. The yellow tubercles on the posterior side of femur are distinct in some specimens and dim in others.

*Remarks.*—*Megalophrys stejneri* is clearly differentiated from *M. montana* (Kuhl), to which it is closely related, by the presence of vocal sacs in the male. The slits are large and distinctly visible on either side of the posterior part of tongue near angle of jaws. The male has a loud "croak" which, during the breeding season, can be heard for a considerable distance. Nearly all the specimens were discovered by hearing the "croak." During a rain they usually come out of their hiding places. All the specimens captured were taken in low mountains

or hills, at elevations not exceeding 300 meters. The tadpoles were taken in small mountain streams, but the specimens preserved were lost. I suspect that many of the Philippine specimens that have been reported as *Megalophrys montana* were really *M. stejnegeri*. Boulenger has reported *M. montana* from Dinagat<sup>37</sup> and Samar;<sup>38</sup> F. Müller<sup>39</sup> and I. G. Fischer<sup>40</sup> both report it from Mindanao.

If the specimens taken were young or females, the vocal sacs may have been overlooked. It is possible, of course, that two species occur in one locality. In view of this possibility I include Boulenger's description of *Megalophrys montana* (Kuhl).

*Megalophrys ligayæ* sp. nov. Plate 10, figs. 2 and 2a.

*Type*.—No. F325, E. H. Taylor collection; collected in northern Palawan, May, 1918, by Victor Lednicky.

*Description of type*.—Vomerine teeth in two strong rounded groups lying between the posterior part of choanæ, separated from each other by a distance equal to one and one-half times the length of a single group; separated from choanæ by a distance about half the length of a single group; choanæ not concealed by overhanging jaw; the distance between the Eustachian tubes distinctly greater than their distance from choanæ; distance between choanæ a little less than distance between nostrils; male with vocal sacs, the openings rather elongate slits; openings distinct, about halfway from posterior part of tongue and angle of mouth; tongue rounded, with a distinct nick behind; head much broader than long; snout rather distinctly pointed in front; eye large, its diameter distinctly less than length of snout; nostril halfway between eye and tip of snout, or slightly nearer tip; tympanum moderately distinct, its greatest length about two-thirds of diameter of eye; separated from eye by a distance nearly one and a half times its greatest length; width of eyelid (exclusive of spine) contained one and one-half times in inter-orbital distance; skin with minute spicules, with larger tubercles on back, sides, and limbs; belly smooth; a short dermal spine on edge of upper eyelid; a distinct fold from eye to above arm; two slightly diverging dorsolateral folds beginning in the occipital region and continuing half the length of body; a rather short dermal spine at angle of mouth; prominent glandular

<sup>37</sup> Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 442.

<sup>38</sup> Proc. Zool. Soc. London 1 (1908) 413.

<sup>39</sup> III. Nacht. Cat. Herp. Samml. Basel Mus. (1883) 11.

<sup>40</sup> Jarhb. Wiss. Anst. Hamburg 2 (1885) 80.

tubercle above insertion of arm, on each shoulder, and in middle of back; several scattered tubercles on back and on upper side of thigh; two prominent glandular mammalike tubercles on breast; skin on head involved in cranial ossification; first finger about as long as second, both extending farther than fourth, tips swollen slightly into blunt disks without grooves; subarticular tubercles not distinct; a rather large swelling at base of first finger; toes apparently entirely free; third distinctly longer than fifth; a large inner metatarsal tubercle as long as first toe; no tarsal fold; hind leg brought forward, the tibiotarsal articulation reaches anterior edge of tympanum.

*Color in life*.—Above olive gray; a backward curved line across head limits the dark occipital area, which continues backward between the dorsolateral folds to end of body; a narrow black line follows the outer side of the dorsolateral folds some distance; most of the tubercles on back dense black; numerous dark flecks scattered through the ground color; an elongate black spot above insertion of arms; outer edge of upper eyelid and spine black; a black loreal stripe and a narrow, black, yellow-edged line below eye, ending in a black spot behind eye; tip of snout dark; upper lip with elongate, yellow-edged spots confluent with those on lower jaw; limbs with very dim bars above; below, throat brownish with islandlike, yellow-edged spots; belly and underside of hind limbs yellow, with brownish spots; distinct black spots on underside of fore limbs; breast tubercles yellow, as are also the tips of the dermal spines on eye and angle of jaw; heel and foot with black spots.

*Measurements of Megalophrys ligayæ sp. nov.*

	mm.
Length, snout to vent	60
Length of head, to angle of jaw	23
Width of head, at tympanum	29
Diameter of eye	7.1
Diameter of tympanum	4.8
Eye to nostril	41
Length of snout	9
Tympanum from eye	7
Interorbital distance	9
Eyelid	6
Foreleg	37
Longest finger	15
Hind leg	74
Femur	25
Tibia	18
Foot (entire)	31
Longest toe	20



*Variation.*—This specimen was collected in Palawan by Victor E. Lednicky. It differs but little from several younger specimens collected by myself in Palawan, now a part of the Bureau of Science collection. A young specimen, which still has a bud of a tail, measures only 13 millimeters in length from snout to vent; the hind legs measure 15 millimeters. It is dark above, throat and chest entirely black, hind legs whitish; tubercles on posterior part of back arranged in a broad V-shaped series, only dimly noticeable in the type. The vomerine teeth are visible in all save the very young specimens.

*Remarks.*—This species, like *Megalophrys stejneri*, differs from *M. montana* in that it has vocal sacs. From *M. stejneri* it differs in that it has vomerine teeth, unconcealed choanæ, a longer and more-pointed snout, smaller eyes, a larger and more-distinct tympanum, a flatter head, and a shorter spine above eye. It also differs in color and markings.

The species is rather common in mountain streams. I strongly suspect that specimens from Palawan, collected by Everett and reported by Boulenger,<sup>41</sup> belong to this species. I did not find the tadpoles of this species.

The species is named for Macario Ligaya, the Filipino artist whose careful drawing has contributed much to the value of this paper.

*Megalophrys montana* (Kuhl).<sup>42</sup>

*Megophrys monticola* KUHL, Isis (1822) 475.

*Megalophrys montana* KUHL in Ferussac, Bull. Sci. Nat. 2 (1824) 83; WAGLER, Syst. Amph. (1830) 204; TSCHUDI, Class. Batr. (1838) 82; DUMÉRIL and BIBRON, Erp. Gén. 8 (1841) 458; GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 36; Ann. & Mag. Nat. Hist. IV 11 (1873) 419; BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 442; Proc. Zool. Soc. London 1 (1908) 411; F. MÜLLER,<sup>43</sup> III Nacht. Cat. Herp. Samml. Basel Mus. (1887) 11; FISCHER,<sup>43</sup> Jahrb. Wiss. Anst. Hamburg 2 (1885) 80; BOETTGER,<sup>43</sup> Ber. Senck. Nat. Ges. (1886) 125; WEBER, Ann. Jard. Bot. Buitenzorg 15 (1898) suppl. 2, 5; LAIDLAW, Proc. Zool. Soc. London (1900) 899; ANNANDALE, Fasc. Mal. Zool. 2 (1903) 275; BARBOUR, Mem. Mus. Comp. Zool. Harvard Coll. 44 (1912) 77, pl. 7, fig. 30.

<sup>41</sup> Ann. & Mag. Nat. Hist. VI 14 (1894) 87.

<sup>42</sup> Doubtfully included.

<sup>43</sup> It is possible, but not certain, that these references should be relegated to the synonymy of *Megalophrys stejneri* sp. nov. and *M. ligayæ* sp. nov. which differ from *M. montana* in the presence of a vocal sac.

*Ceratophrys montana* GRAVENHORST, Delic. Mus. Zool. Vratislav. (1829)

47; SCHLEGEL, Abbild. (1837) 29, pl. 10, fig. 3.

*Ceratophryne montana* SCHLEGEL, Handl. Dierk. 2 (1858) 57.

*Megalophrys montana* GÜNTHER, Rept. Brit. India (1864) 413, part.

*Megalophrys montana* var. *aceras* BOULENGER, in Annandale and Robinson, Fasc. Mal. Zool. (1903) 131, pl. 5, fig. 1.

*Description of species.*—(From Boulenger.)<sup>44</sup> "Tongue entire or feebly nicked behind. Vomerine teeth usually present, in two widely separated small groups just behind the level of the choanae. Head large,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  times as broad as long, usually defined behind by a more or less distinct transverse fold; snout truncate or obtusely pointed, projecting beyond lower jaw, as long as or a little shorter than eye; canthus rostralis sharp; loreal region vertical or a little oblique, concave; nostril equally distant from eye and from end of snout; interorbital space concave, its width  $1\frac{1}{2}$  to 2 times that of upper eyelid (narrower in the very young); tympanum usually feebly distinct, rarely hidden, its diameter  $\frac{1}{2}$  to  $\frac{2}{3}$  that of eye, from which it is separated by a distance equal to the diameter of the latter. Fingers obtuse or feebly swollen at the end, first as long as or a little longer than second, which measures  $\frac{2}{3}$  to  $\frac{3}{4}$  length of third; no subarticular tubercles; no distinct metacarpal tubercles. Toes rather short, obtuse or feebly swollen at the end, with a mere rudiment of web or, at most,  $\frac{1}{4}$  webbed; no subarticular tubercles; a flat, very indistinct inner metatarsal tubercle. Tibio-tarsal articulation reaching the shoulder, the commissure of the jaws, or the temple; tibia  $\frac{3}{8}$  to  $\frac{1}{2}$  length from snout to vent; foot as long as or shorter than tibia. Skin of upper parts smooth or with scattered conical warts, old specimens with bony deposits on the head and anterior part of the back; a strong glandular fold from eye to shoulder, usually another on each side of the back; upper eyelid with a sharp, raised edge, which is produced into a more or less distinct point or "horn;" this point may be very indistinct (var. *aceras* Blgr.), or very much developed, measuring nearly  $\frac{2}{3}$  diameter of eye; as a rule it does not measure more than  $\frac{1}{2}$  diameter of eye; an indication of a similar appendage on the tip of the snout rarely present; \* a more or less developed pointed tubercle usually present behind the commis-

<sup>44</sup> Proc. Zool. Soc. London 1 (1908) 411.

\* In a specimen from Java, where the species is most abundant."

sure of the jaws; limbs usually with oblique transverse glandular ridges; throat smooth, belly with small tubercles."

*Color*.—"Olive-brown above, uniform or variously marked with darker or lighter; a more or less distinct large triangular dark spot between the eyes, the base forwards, and a dark oblique bar below the eye; limbs with more or less distinct dark cross-bars; lower parts pale brown, spotted or marbled with darker; a white tubercle on each side of the breast. Male without vocal sac."

*Measurements of Megalophrys montana (Kuhl).*

	Male. mm.	Female. mm.
Length, snout to vent	55	88
Length of head, to occiput	19	27
Width of head	29	43
Length of snout	6	8
Diameter of eye	6	8
Interorbital width	10	14
Diameter of tympanum	4	4
Distance between eye and tympanum	6	9
Foreleg	35	53
Hand	16	23
Hind leg	70	110
Tibia	23	35
Foot	21	35

*Remarks*.—(From Boulenger.) "It is a sluggish and thoroughly nocturnal animal. Nothing has been observed concerning its breeding-habits; but I find the eggs to be large, those in the oviduct of a specimen 83 millim. long measuring 3 millim. in diameter. \* \* \* tadpoles are found in mountain streams with gravelly beds and are remarkable for the funnel-like float formed by the lips, which are beset with minute horny teeth; these are not connected in any way with definite ridges or lamellæ, but radiate along the anterior surface of the funnel. According to Annandale, the funnel-shaped lip is capable of assuming two very distinct forms, according to the position of the tadpole:—(1) When the animal is hanging from the surface-film, as it frequently does, this structure becomes a translucent rhomboidal or lozenge-shaped float, depressed in the center towards the mouth, but otherwise nearly flat; (2) when, on the other hand, the animal is resting on the bottom, the float takes on the appearance of a pair of slender processes, continued upwards on the sides, like a pair of horns. As in other

Pelobatidæ, the spiraculum is sinistral. The tail is more than twice as long as the body, the total length of the largest tadpole being about 40 millim. The coloration is of a very dark brown, even on the belly."

*Megalophrys hasselti* (Tschudi). Plate 8, figs. 4 and 4a.

*Leptobrachium hasseltii* TSCHUDI, Class. Batr. (1838) 81; GÜNTHER, Cat. Batr. Sal. (1858) 36; BOULENGER, Cat. Batr. Ecaud. (1882) 441; Zool. Rec. (1885), Rept. 24; Proc. Zool. Soc. London (1890) 37; Fauna Brit. India, Rept. (1890) 511; ISENSCHMID, Mitth. Nat. Ges. Bern (1903) 20; VAN KAMPEN, Zool. Jahrb. Syst. 22 (1905) 712.

*Rana hasseltii* SCHLEGEL, Handl. Dierk. (1858) 56, pl. 4. fig. 71.

*Megalophrys hasselti* BOULENGER, Proc. Zool. Soc. London 1 (1908) 425.

*Description of species.*—(From Boulenger, Proc. Zool. Soc. London, 1908.) "Tongue nicked behind. Vomerine teeth absent. Head large, about once and  $\frac{1}{4}$  as broad as long; snout rounded, not projecting beyond lower jaw, about as long as orbit; canthus rostralis distinct; loreal region very oblique, concave; nostril a little nearer end of snout than eye; interorbital space a little broader than upper eyelid; tympanum hidden or feebly distinct, its diameter  $\frac{1}{2}$  to  $\frac{2}{3}$  that of eye, from which it is separated by a space less than its own diameter. Fingers obtuse, not swollen at the end, first and second equal or first the longer, third nearly twice as long as second; subarticular tubercles, if distinct, irregular in their disposition; two moderately large carpal tubercles, inner a little larger than outer. Toes short, obtuse, like the fingers, webbed at the base in females,  $\frac{1}{4}$  to  $\frac{1}{2}$  webbed in males; third toe not reaching beyond base of antepenultimate phalanx of fourth; subarticular tubercles sometimes distinct, sometimes more or less confluent into an obtuse ridge; inner metatarsal tubercle small, oval, feebly prominent. Tibio-tarsal articulation reaching the shoulder; tibia  $\frac{1}{3}$  to  $\frac{2}{5}$  length from snout to vent; foot as long as head. Skin smooth or with small tubercles above, granular on belly; a glandular fold from eye to shoulder."

*Color.*—"Brown, grey, or pale olive above, with small or large dark brown spots or marblings, which may be irregular or form a symmetrical pattern; a more or less distinct dark canthal and temporal streak; sides of snout with dark vertical bars; limbs with dark cross-bars; throat and belly dirty white, or brown speckled with white. Male with an internal vocal sac."



*Measurements of Megalophrys hasselti (Tschudi).*

	Male. mm.	Female. mm.
From snout to vent	47	74
Length of head, to occiput	16	23
Width of head	20	31
Length of snout	6	10
Diameter of eye	5	9
Interorbital width	6	10
Diameter of tympanum	3	6
Distance between eye and tympanum	2	4
Foreleg	33	50
Hand	11	16
Hind leg	53	79
Tibia	16	24
Foot	15	23

"The larva has been first noticed by me, from specimens from Sumatra and Perak, and others have since been obtained in Selangor by Mr. Butler, and in Perak by Dr. Hanitsch. These tadpoles are of the same type as the typical Pelobatids of Europe, but remarkable in being marked all over with numerous deep black dots or round spots. No observations have been made on the breeding-habits, but it is probable that the eggs are laid in the water, being similar to those of *Pelobates*. Eggs from the oviducts of a female 65 millim. long measure 2 millim. in diameter.

"Mr. A. L. Butler observes (Journ. Bombay N. H. Soc. xv. 1904, p. 397) that the larval period of existence is very prolonged, and that the tail does not disappear until the size of about 40 millim. (from snout to vent) is attained."

## ILLUSTRATIONS

[Drawings by M. Ligaya; photographs by E. Cortes.]

### PLATE 1

- FIG. 1. *Oxyglossus lævis* Günther. After Günther, Cat. Batr. Sal. Brit. Mus. (1858), pl. 1, fig. A.
2. *Rana erythræa* (Schlegel). Photograph of a preserved Negros specimen, E. H. Taylor collection; reduced.
3. *Philautus leitensis* (Boulenger). Photograph of a preserved specimen, No. B38, Bureau of Science collection; about natural size.
4. *Rana moellendorffi* Boettger. Photograph of a preserved Palawan specimen, Bureau of Science collection; about natural size.
5. *Rana moodiei* sp. nov. Photograph of the preserved type specimen; reduced.

### PLATE 2

- FIG. 1. *Rana leytensis* Boettger. Photograph of a preserved specimen; somewhat reduced.
2. *Rana magna* Stejneger. Photograph of a preserved Polillo specimen; greatly reduced.
3. *Rana vittigera* Wiegmann. Photograph of a freshly killed specimen; greatly reduced.
4. *Polypedates leucomystax* (Gravenhorst). Photograph of a newly killed specimen; natural size.

### PLATE 3

- FIG. 1. *Cornufer laticeps* sp. nov. Drawing of the type; slightly reduced.
2. *Philautus hazelæ* sp. nov. Drawing of the type; natural size.
3. *Chaperina beyeri* sp. nov. Drawing of the type; natural size.
4. *Rana parva* sp. nov. Drawing of the type; natural size.
5. *Philautus montanus* sp. nov. Drawing of the type; natural size.

### PLATE 4

- FIG. 1. *Polypedates pardalis* (Günther). Photograph of the type of *Rhacophorus rizali* Boettger.
2. *Staurois natator* (Günther). 2a, mouth. After Günther, Cat. Batr. Sal. Brit. Mus. (1858), pl. 4, fig. C.
3. *Cornufer corrugatus* (Duméril). 3a, mouth; 3b, foot. After Günther, Cat. Batr. Sal. Brit. Mus. (1858), pl. 8, fig. 3 (*Platymantis plicifera*).
4. *Rana mearnsi* Stejneger. Photograph of a preserved Negros specimen; much reduced.
5. *Rana similis* (Günther). Photograph of a preserved Luzon specimen; somewhat reduced.

## PLATE 5

- FIG. 1. *Rana glandulosa* Boulenger. 1a, mouth; 1b, underside of head, showing arm glands. After Boulenger, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882), pl. 7.
2. *Rana sanguinea* Boettger. Photograph of a preserved Busuanga specimen; somewhat reduced.

## PLATE 6

- FIG. 1. *Rana everetti* Boulenger. 1a, side of head; 1b, mouth. After Boulenger, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882), plate.
2. *Polypedates pardalis* (Günther). 2a, mouth. After Günther, Cat. Batr. Sal. Brit. Mus. (1858), pl. 6, fig. D.

## PLATE 7

- FIG. 1. *Hazelia spinosa* sp. nov. Drawing of the type; natural size.
2. *Rana grandocula* sp. nov. 2a, side of head. Drawing of the type; natural size.
3. *Nectophryne lighti* sp. nov. 3a, side of head. Drawing of the type;  $\times 4$ .

## PLATE 8

- FIG. 1. *Cornufer guentheri* Boulenger. 1a, mouth. After Boulenger, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882), pl. 11, fig. 3.
2. *Polypedates appendiculatus* (Günther). 2a, foot; 2b, mouth. After Boulenger, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882), pl. 8, fig. 4.
3. *Cornufer meyeri* (Günther). After Boulenger, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882), pl. 11, fig. 4.
4. *Megalophrys hasselti* (Tschudi). 4a, side of head. After Boulenger, Proc. Zool. Soc. London (1898) plate.

## PLATE 9

- FIG. 1. *Kaloula conjuncta* (Peters). Photograph of a preserved Mindanao specimen; somewhat reduced.
2. *Kalophrynus stellatus* Stejneger. Photograph of a preserved specimen; natural size.
3. *Chaperina visaya* sp. nov. Photograph of the type; enlarged.
4. *Kaloula picta* (Bibron). Photograph of a preserved specimen; natural size.
5. *Bufo philippinicus* Boulenger. Photograph of a preserved specimen; somewhat reduced.

## PLATE 10

- FIG. 1. *Megalophrys stejnegeri* sp. nov. Drawing of the type; natural size. 1a, side of head.
2. *Megalophrys ligayæ* sp. nov. Drawing of the type; natural size. 2a, side of head.

## TEXT FIGURES

- FIG. 1. *Rana erythræa* (Schlegel). *a*, side of head; *b*, hand; *c*, foot.  $\times 1$ .  
2. *Rana mearnsi* Stejneger. *a*, side of head; *b*, top of head; *c*, hand; *d*, foot.  $\times 1$ .  
3. *Cornufer guentheri* Boulenger. *a*, side of head; *b*, top of head; *c*, hand; *d*, foot.  $\times 2$ .  
4. *Cornufer meyeri* (Günther). *a*, side of head; *b*, foot; *c*, hand.  $\times 2$ .  
5. *Cornufer corrugatus* (Duméril). *a*, side of head; *b*, foot; *c*, hand.  $\times 2$ .  
6. *Kaloula picta* (Bibron). *a*, side of head; *b*, foot; *c*, hand.  $\times 2$ .  
7. *Kaloula baleata* (Müller). After Boulenger. *a*, hand; *b*, foot.  
8. *Kaloula conjuncta* (Peters). *a*, side of head; *b*, foot; *c*, hand.  $\times 1$ .  
9. *Bufo melanostictus* Schneider. After Stejneger. *a*, top of head; *b*, side of head; *c*, hand; *d*, foot.







PLATE 1. PHILIPPINE AMPHIBIA.



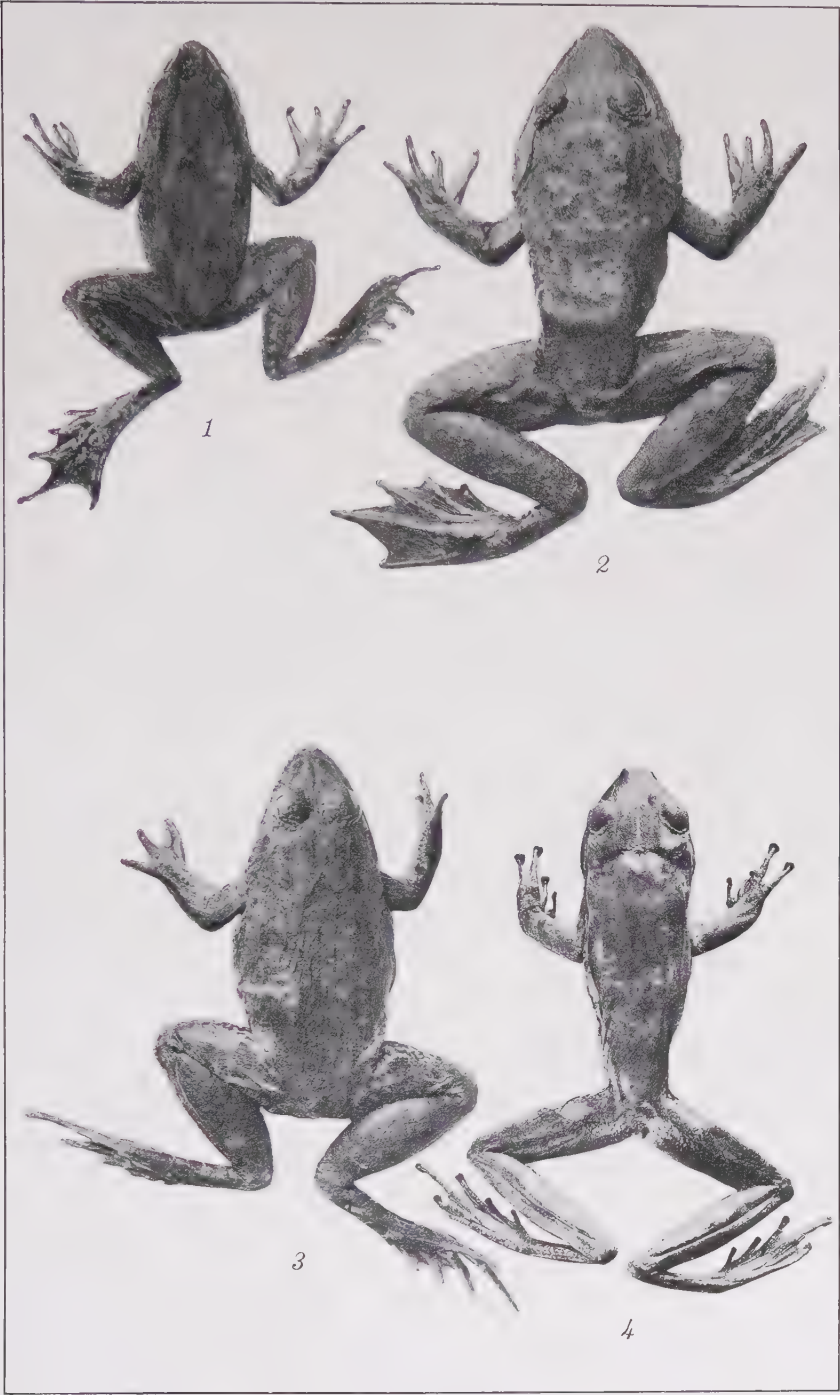


PLATE 2. PHILIPPINE AMPHIBIA.







PLATE 3. PHILIPPINE AMPHIBIA.





PLATE 4. PHILIPPINE AMPHIBIA.





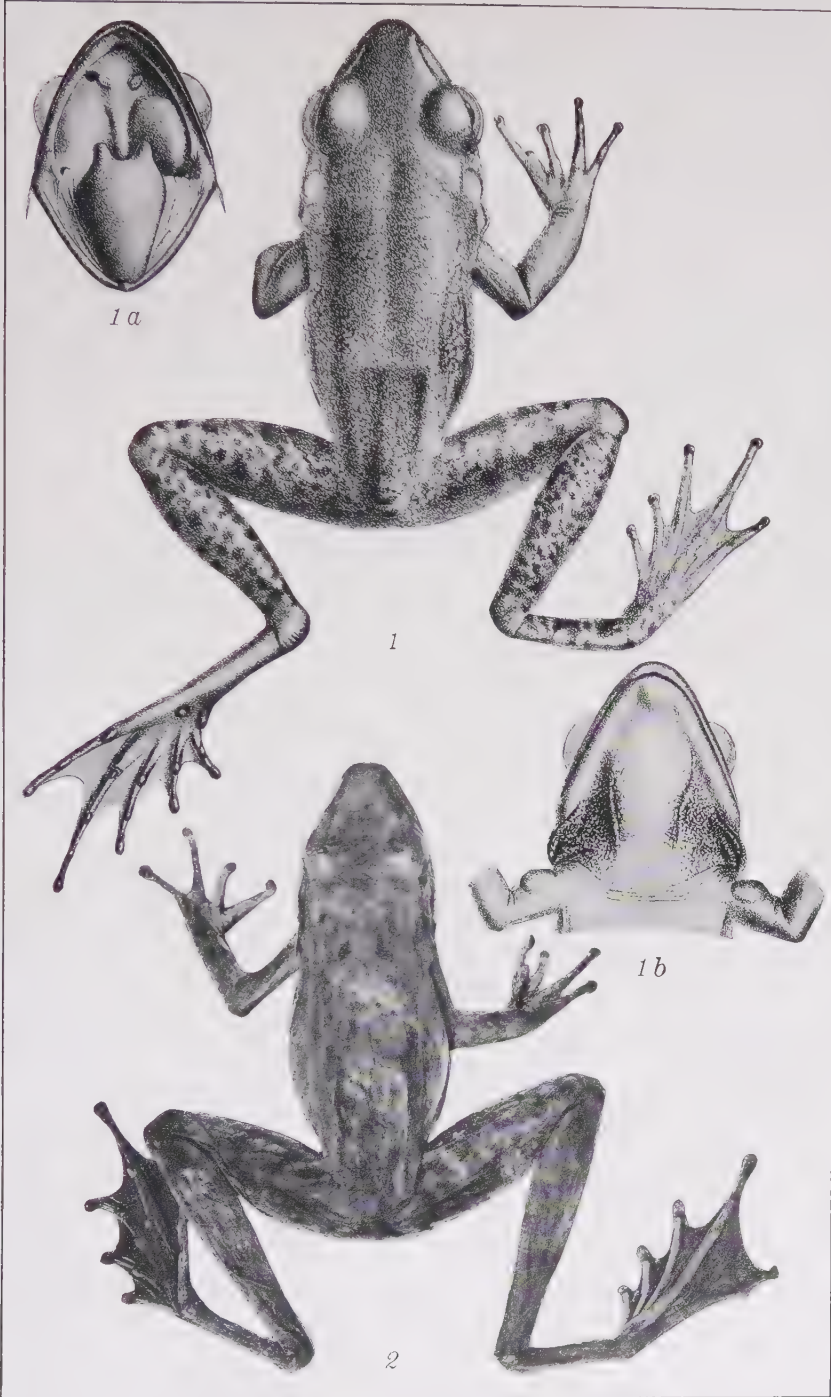


PLATE 5. PHILIPPINE AMPHIBIA.





PLATE 6. PHILIPPINE AMPHIBIA.







PLATE 7. PHILIPPINE AMPHIBIA.



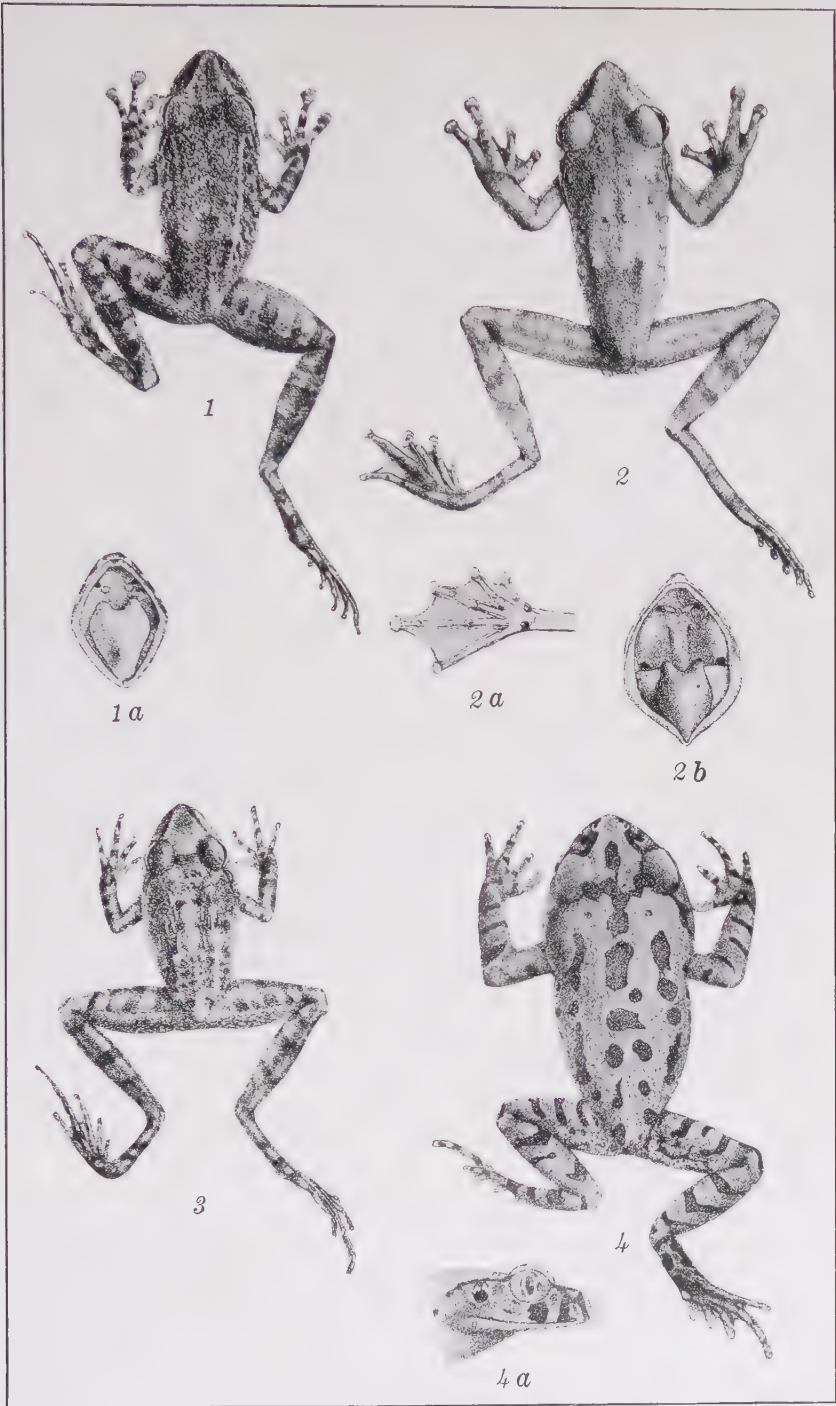


PLATE 8. PHILIPPINE AMPHIBIA.







PLATE 9. PHILIPPINE AMPHIBIA.



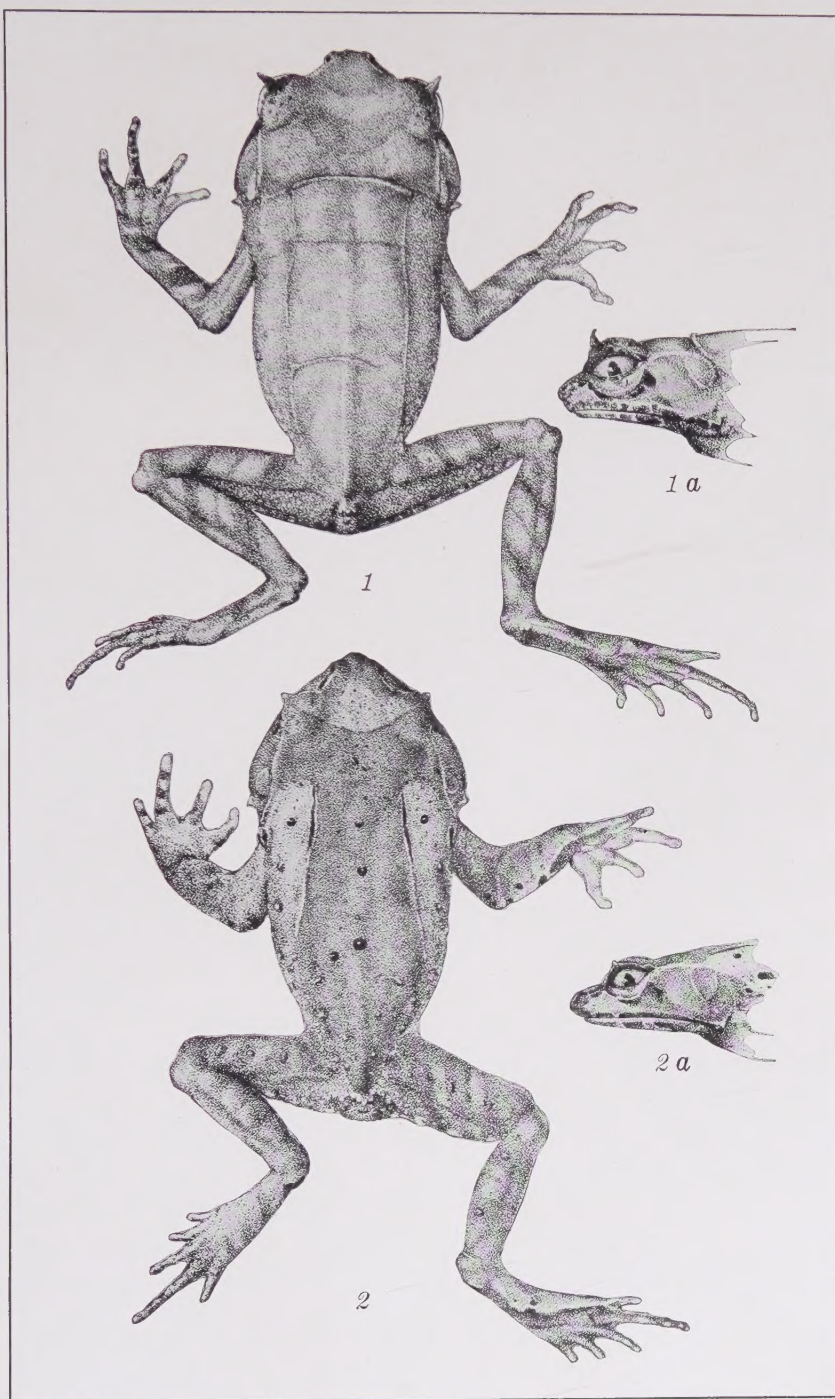


PLATE 10. PHILIPPINE AMPHIBIA.



